

CLASS 72, METAL DEFORMING**SECTION I - CLASS DEFINITION**

This is a restricted class for the art of metal deforming as defined in this class definition.

For original placement of a patent in this class, its claimed disclosure should meet the minimum requirements of the class definition and should not exceed beyond the boundaries indicated in Scope of the Class and discussed in Lines With Other Classes.

Users of this class are urged to consult the above-noted sections as an aid in placing patents or in locating patented art involving metal deformation, whether in Class 72 or in related classes.

Criteria for Placement of Documents in this class contains useful information for the searcher with regard to location of original patents, cross-references, and non-patent literature in Class 72.

Terms followed by an asterisk (*) will be found to be defined in the Glossary. Certain very frequently appearing terms, such as Work, Product, and Tool, are accompanied by the asterisk only where the exact meaning of the term is deemed particularly important.

The diagrams appearing in connection with certain defined terms in this class definition and certain subclass definitions are intended as aids in distinguishing among separately classified concepts, and are not to be considered as limitations on the structural embodiments of the defined subject matter. The following reference characters have uniform meanings where they appear in the diagrams.

C = Work-gripping clamp*

C-D = Closed die*

P = Product*

R = Ram or Roller* (as will be evident from the diagram)

T = Actuated tool* (may be a die)

T1, T2 = Tool couple* (at least one actuated tool)

T1, T2, T3 = Tool complex* (at least two actuated tools)

W = Work* or Blank*

(arrow) = Motion of work, tool, etc.

Class 72 is the residual locus for patents directed to a process or apparatus for the mechanical treatment of metal work (elemental metal or mixture of metals) in a self-shape-sustaining state, to change the shape or size of such work, without removal of material therefrom, (a) by the direct application of mechanical force or pressure to the work, or (b) by the application of energy to induce the generation of mechanical stress within the work, which force, pressure, or stress produces a permanent change of shape in some portion of the work (i.e., exceeds the elastic limit of the work).

SCOPE OF THE CLASS

Class 72 is intended to be the locus for patents directed to a process or apparatus for the deformation of metal work by the direct, or indirect, application of mechanical stress thereto while the work is in a self-sustaining state (i.e., not powdered or melted).

Since metal deformation is typically one of a number of differentiated steps in the manufacture of specific commercial products, the preponderance of art discloses metal-deformation methods, or means in combination with other methods, or means of extraneous or nonclass type. It has, accordingly, been found necessary to admit some such combinations while otherwise maintaining Class 72 as a generally restricted class. The sole positive requirement for placement of a patent, as an original copy, in Class 72 is its claimed disclosure of a metal-deforming process or apparatus. A patent claiming metal deformation may, however, be excluded from the class because of claimed extraneous subject matter not expressly covered in the subclass titles and definitions. Claimed subject matter which bars a patent from original placement in Class 72 may be summarized as follows, in Lines With Other Classes and Within This Class, below.

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

(A) Separately claimed product of manufacture. Class 428, Stock Material or Miscellaneous Articles, subclasses 544+ provide for stock material, e.g., of indefinite length, which are all metal or have adjacent metal components; in particular, subclasses 577+ provide for metallic blanks and other intermediate articles.

(B) The presence, either alone or in combination with

metal deforming, of a recognized treatment of metal provided for in another existing class and not appearing in a subclass title in this class (e.g., anodizing, assembling of preforms, casting, cathode-sputtering, chemical-machining, electron beam, or laser-machining, use of adhesive, specific heating treatment, melting, welding, etc.).

(C) The combination with a recognized treatment provided for in another existing class and not performed under the conditions, or with the limitations specifically stated in a subclass definition in this class (e.g., coating a final product of metal deformation, cutting solely of a nonmetal, or a nonsystematic cutting of metal).

(D) The combination with other treatment(s) not excluded as such from Class 72, but the combination being directed to the manufacture of a special product which has been recognized in certain other existing classes (e.g., bolt- or nut-making, needle- or pin-making, manufacture of barrier layer devices, etc.). (See RELATIONSHIP TO OTHER CLASSES PERTAINING TO METAL DEFORMING, below)

(E) Deformation of metal wire, as such, and in particular the formation of certain products therefrom (e.g., hairpins), remains subject matter for Class 140, Wireworking. (See RELATIONSHIP TO OTHER CLASSES PERTAINING TO METAL DEFORMING, below)

SUMMARY

Specific questions involving the above-listed exclusory lines may be decided by reference to the following sections of this class. Certain features ancillary to metal deforming are provided for in this class (e.g., work or product handling, heating or cooling, descaling, lubrication, automatic control, etc.), but other treatment elsewhere classified (e.g., assembly, welding) are always a bar to original placement in Class 72.

CRITERIA FOR PLACEMENT OF DOCUMENTS IN THIS CLASS

(A) The schedule of Class 72 was developed with strict adherence to schedule superiority.

Original placement of U. S. patents is determined by their claimed disclosure, with the following exception. Patents granted prior to 1910 are generally, but not necessarily, placed by claimed disclosure. The presence of significant unclaimed subject matter in such an older patent, if of higher schedule superiority than the claimed invention, may determine its original placement in the

higher subclass, with such cross-referencing downward as appears helpful and in accordance with established procedure.

(B) Cross-referencing, of U. S. patents only, is intended to account for significant, but unclaimed, disclosure, as well as subordinate, but distinct, inventions related to basic subject matter of the class.

(C) Foreign patents and nonpatent literature are placed solely on the basis of "useful disclosure" without strict regard to schedule superiority or to specific limitations in subclass definitions.

(D) "Claimed disclosure" is defined as the combination of elements recited in the controlling claim of a patent, together with such features of the recited elements as must be imputed from the disclosure to render the claimed combination complete and operative for the functions referred to in the claim. For example, if alternative dies are disclosed in the specification of a machine, but not identifiably recited in the claim, the term "die" is construed broadly for the purpose of original placement. If the claim refers to a die bore, that die which is disclosed as having a bore will be read into the claim. Other features of the so-identified die (e.g., a vent hole) will not be deemed part of the claimed disclosure unless some reference thereto appears in the claim.

(E) "Useful disclosure", for the purpose of this schedule, may be the total disclosure of a document, or in the case of multiple disclosures or of a broad combination, it may be that portion of the total disclosure which, in the opinion of the classifier, is most significantly related to the basic subject of Class 72.

(F) Examples of Placement of U. S. Patents:

(1) A claim to a motor-driven press includes claimed complementary dies to form a faceted reflector unit from sheet tungsten, with automatic angular indexing of work between press strokes and automatic stopping upon completion of 360 degrees of indexing.

Original copy is placed in subclass 30.1, cross-references in subclasses 414 and 422; additional cross-reference in art collection subclass 700 is desirable.

(2) A claim recites the steps of cutting a predetermined length of steel strip from a coil, mechanically gripping the ends of the cut blank, heating the central portion thereof, and wrapping the blank under tension about a contoured forming block.

Original copy is placed in subclass 294, cross-referenced in subclasses 296 and 342.1+. (Additional cross-references in subclass 339, severing a blank from stock; in subclass 364, process, temperature modification; and in subclass 372, process using claimed apparatus; also may be desirable, depending upon apparent novelty in these details.)

(3) A claim recites only a pair of dies with configured faces, one die having a replaceable face portion to alter a dimension of the product:

Original copy is placed in subclass 473. No upward cross-reference is necessary because press features such as drive, guides, etc., are presumed to be conventional.

RELATIONSHIP TO OTHER CLASSES PERTAINING TO METAL DEFORMING, PER SE

The following enumeration and discussion of classes does not purport to be exhaustive, but includes loci of patents relating to, per se, metal deforming wholly or in part.

(A) CLASSES OF ARTICLE MAKING:

A recitation, in a process or apparatus claim, of the article being made will result in original placement of the patent containing such claim in the appropriate article-making class, except that a claim which recites only a step of, or use of an instrumentality for, performing a single metal-deforming operation will be placed in this class (72).

See References to Other Classes, below, for examples of such classes (or portions of classes) directed to the manufacture of particular products.

(B) THE CLASS OF WIREWORKING:

The class of reference (140, Wireworking) includes patents for certain wire-deforming operations (e.g., Barbing, Knotting, Crimping) named in subclass titles of the class. The lines that existed between Class 140 and other metal-deforming classes will (e.g., Metal Bearding, Metal Forging, etc.) continue to be observed, and this class (72) will serve as the repository of patents not provided for in Class 140.

(C) THE CLASSES OF MEASURING AND TESTING:

Class 73 includes patents for structures that deform

metal by “stress or strain of material of structure” (see Class 73, subclasses 788+). Class 374 including determining the thermal response of deformation (Class 374, subclasses 46+), and resistance to a thermally induced deformation. The question of patent placement will usually be resolved by the specification's disclosing, on one hand, deformation to effective destruction (for Classes 73 or 374), or, on the other hand, deformation to form a product (for Class 72).

RELATIONSHIP TO COMBINATION CLASSES

A patent claim directed to a combination of a metal-deforming step or apparatus with other treatment or apparatus, not specifically provided for in Class 72, is excluded from this class and is generally placeable as noted in the following paragraphs.

(A) WITH ASSEMBLING:

(1) “Assembling” denotes the juxtaposing or joining of two or more “preforms” (discrete objects, as distinguished from material applied as coating, filling, or added as alloy, etc.).

(2) Methods of, and means for, assembling preforms are provided for in other classes, and residually in Class 29, Metal Working. More specifically, if a patent claim recites a step of (or apparatus for) metal deformation which, as disclosed, recognizes or requires the presence of two or more discrete members, at least one of which is the subject of the metal-deforming operation, and the deforming operation results in securing at least two of the members together, the claim is excluded from Class 72 and must be placed in another class, such as Class 29. For example, a claim directed to the step of riveting or staking two metal objects together is proper subject matter for Class 29, Metal Working, subclasses 428+ (Assembly and/or Joining).

(3) The following two operations are distinguishable from the above-noted assembling of preforms and are proper subject matter for Class 72: (a) Method of, or apparatus for, joining spaced portions of the same workpiece solely by metal deformation (e.g., lock-seaming a tube). (b) Method of, or apparatus for, extruding a metallic sheath on a core.

(4) References With Other Classes, below, contains citations to classes that illustrate the location of patented art involving metal deformation in combination with assembly of plural members.

(B) WITH CUTTING

(1) Class 72 is the locus for patents directed to the combination of metal deforming and cutting* (method or apparatus), provided that the same material is treated, and in a systematic manner. In other words, the combination of metal deforming and cutting is proper subject matter for this class, with only two exceptions:

(a) Disclosure that cutting and metal deforming are performed only on different work. For example: (i) Device to forge a metal part and to punch an attached or associated record card (Class 29). (ii) Combined plier-type insulation stripper and wire end bender (Class 7). (iii) Method of embedding a metal core in plastic material, bending to a desired shape, and trimming off excess plastic (Class 264).

(b) Disclosure fails to teach a systematic, i.e., simultaneous or predetermined, orderly sequential operation of cutter and metal-deforming means on the same work. For example: (i) Hand punch with a turret of manually selectable cutting and embossing dies (Class 7). (ii) Punch press with interchangeable cutting and bending dies or die inserts (Class 29). (iii) Set of hand tools for severing, incising, and stamping metal (Class 7). (iv) Wire-crimping pliers with separately accessible side-cutting dies (Class 7). (v) Press structure having spaced cutting and forging tool stations; no work feed means (Class 29).

(2) In summary, it is further noted that:

(a) A patent otherwise barred from Class 72 will not be originally placed herein because of the inclusion of cutting.

(b) Patents to cutting tools or apparatus, per se, are excluded from Class 72.

(c) “Convertible” cutting and metal-deforming apparatus, i.e., requiring the intervention of an operative to effect the conversion, is generally excluded from the subject matter of this class.

(d) “Combined” apparatus, in the sense of mere side-by-side or jointly driven cutting and metal-deforming devices, independently or alternatively usable at the will of an operative, is generally excluded.

(e) Combinations excluded from Class 72 under the foregoing discussion are generally placeable in Class 7 or Class 29, as illustrated in examples under RELATIONSHIP TO COMBINATION CLASSES, With Cutting, paragraph 1, above.

(C) WITH HEAT TREATMENT:

(1) “Heat Treatment” refers to the establishment or maintenance of a given, relatively permanent, physical or chemical condition in work by heating or cooling it in a prescribed manner.

(2) A patent directed to the combination of metal deformation and heat treatment of work will be placed as follows:

(a) In Class 219, Electric Heating, when electric heating (e.g., resistance, induction) is involved.

(b) In Class 72, when the patent is not otherwise excluded, when the heat treatment is effected by other than electrical means, and the heat treatment is: (i.) unspecified (heating or cooling broadly claimed); (ii) for conditioning work to a suitable temperature for a metal-deforming operation; (iii) process annealing, i.e., for relieving stress due to a prior working or preparatory to a following operation; or (iv) for returning work or product to a desired ambient or handling temperature.

(1) Note. The term “quenching” is sometimes inaccurately used to denote mere cooling to a convenient temperature. Such usage will not bar placement of a patent in Class 72.

(c) In Class 148, Metal Treatment, if there is significant heat treatment to modify or maintain the internal physical structure (i.e., microstructure) or chemical property of metal combined with a metal deforming operation of Class 72, see References to Other Classes in the Class 148 definition. Significant heat treatment occurs when the temperature or heating or cooling rate is provided in a nonworking related step or when microstructure description is utilized in the claim to describe the heating or cooling treatment of the metal. Working at a specified temperature without mention of microstructure is not significant heat treatment for Class 148. The mere use of the term “ageing” or “tempering” is considered significant heat treatment for Class 148. Except for “Work-Hardening” which is proper in Class 72, the use of the term “hardening” will be considered significant heat treatment for Class 148. “Quenching” will be considered significant heat treatment lacking an indication that it means simply returning to a convenient working

temperature (which belongs in Class 72 as stated above). “Stress-relief-annealing” will remain in Class 72, if combined with a metal deforming operation. Working metal in the “superplastic” state or during “dynamic recrystallization” remains in Class 72 unless a temperature is provided in the working step. If temperature is provided for the superplastic working step, classification will go to Class 148. When combined with metal deforming, “annealing”, per se, goes in Class 72. However, annealing at a specified temperature goes in Class 148. Merely heating or cooling a metal to a working temperature is not significant heat treatment for Class 148. The presence of reactive coating in any step of a metal treating process goes to Class 148. Combinations of chemical-heat removing (i.e., flame-cutting) or burning with metal working go to Class 148.

(d) In Class 266, Metallurgical Apparatus, if the apparatus is for heat-treating solid metal and see the definitions therein for the line to Class 72.

(D) WITH CLEANING, COATING, OR OTHER TREATMENT:

The following remarks apply both to apparatus and to process claims.

(1) The combination of metal deforming with cleaning, descaling, or application of lubricating material to the work material before, during or after metal deformation is provided for in Class 72.

(2) The combination of metal deforming with exposure of the work, before or during deformation, to gas, vapor, mist, or modified atmosphere, is provided for in Class 72. Examples of this combination are: the deformation or work in an evacuated chamber, or in the presence of an inert gas, or the spraying or sputtering of material on work before deformation. For the classification of metal deforming followed by coating, see Class 29, Metal Working, subclasses 527.1+ and associated search notes.

(3) The combination of metal deformation with the prior or simultaneous application of fluent material to an existing workpiece, by any such technique as casting, coating, or molding, is provided for in Class 72. The only exception involves electric arc deposition of metal, which combination is placeable in Class 219, Electric Heating. Any

claimed casting, coating, or molding of material upon a product subsequent to a final step of metal deforming is proper subject matter for Class 29 as the residual locus, or for Classes 427 and 264 for specific methods, or Class 118 for apparatus.

(4) The combination of initially making a metallic workpiece by casting or molding, followed by deformation thereof, is excluded from this class, and is generally proper subject matter for Class 29, Metal Working. Certain perfecting treatments of cast metal while in the mold are classifiable in Class 164, Metal Founding. An apparent exception is the charging of an extrusion container with molten metal; in this instance, the pouring of molten metal is regarded as a convenient technique of handling work for later extrusion, rather than a casting for Class 164, Metal Founding, or a combination involving casting for Class 29. Subclasses 253.1 of this class (72) provide for this combination of charging metal into a container and extruding it therefrom.

(E) WITH BODILY TRANSFERRING OF TOOL TO OR FROM TOOL SUPPORT OR STORAGE MEANS:

The following remarks apply to either a process or apparatus claim.

Metal deforming combined with bodily transfer or exchange of a deforming tool to or from a tool support (i.e., tool driver) or a storage means is proper for Class 483, Tool Changing, with the exception of deforming limited to roller couple tools with means to introduce or remove at least one roller with respect to the couple which is provided for in Class 72, subclasses 238 and subclasses indented thereunder.

RELATIONSHIP TO SUBCOMBINATION CLASSES

(A) THE WORK-HANDLING OR PRODUCT-HANDLING CLASSES:

The placement of patents claiming method of, or apparatus for, the handling of work for, or the product of, a deforming operation and also claiming the deforming method or means will be in this class unless the deforming method or means is not recited significantly.

In this connection, a step of deforming (in a method claim) is considered significant even if it only indicates the type of deformation, e.g., “rolling”, “bending”, “spin-

ning". On the other hand, a claimed step of handling to a named type of deforming instrumentality, e.g., "rolling mill", "bending brake", "spinning station", is not deemed to set forth a significant deforming step and thus is proper for a handling class. If however, such instrumentality is further identified in terms of deforming function such as "three-high rolling mill", "hot metal bending brake", "pattern-controlled spinning station", such claimed terminology will import a significant deforming step and warrant placement of a patent in Class 72.

In a claim directed to apparatus, examples of broadly recited and not significant deforming means, which would permit original placement of a patent in an appropriate handling class, include "rolling mill", "working station", "forging press", and similar terms; however, a significant relationship of work-handling and deforming means would be proper for class (72), such as "means to insert the billet into the upper pass of a three-high rolling mill". The quoted phrases should be considered as exemplary, not as all-inclusive.

Examples of classes directed to work-handling or product-handling are listed in References to Other Classes, below.

(B) THE CLASSES RELATING TO TOOL DRIVING:

(1) This class (72) provides for patents claiming means for driving a tool that is restricted, as disclosed, by its shape or its tool-face or its composition to its function of deforming metal.

(2) Patents claiming a means for driving a tool which tool is recited by name only (both in the claim(s) and in the specification), will be placed in a class appropriate to the power source, transmission, or the machine as disclosed.

(3) Among the classes directed to such latter driving means are the following:

(C) CLASSES (OR PORTIONS OF CLASSES) PROVIDING FOR A TOOL OR TOOLFACE, PER SE:

See References to Other Classes, below for examples of classes directed to such subject matter.

OTHER CLASS RELATIONSHIPS

(A) CLASSES INCLUDING DEFORMING OF NONMETALS:

(1) Class 72 is the residual locus for the plastic deformation of metallic work, (a) as simple metal stock or blanks, (b) in combination with nonmetal, as in the case of metal and paper laminates, or (c) as unspecified or unidentified material which appears by disclosure to be metal (e.g., referred to as "ingot", "rail", "axle blank"). The additional deformation of nonmetallic material (e.g., in a laminate or other composite work) will not bar placement of a patent in this class.

(2) A claimed disclosure of deformation of a nonmetal only is subject matter for another class. Typical classes are listed in the References To Other Classes, below.

(B) CLASS 242, WINDING, TENSIONING, OR GUIDING

(1) With respect to winding, Class 72 and Class 242 contain patents wherein work is disclosed as being held to a mandrel or core and wound thereon due to interaction of (a) a force rotating the core and (b) a force restraining the work to movement along a course substantially tangent to the surface of the core or the wound product.

Patents disclosing such forces applied to metal and claiming use of a deflector closely adjacent the core will be placed originally in Class 72 unless the specification clearly teaches that the metal is not deformed or stressed beyond its elastic limit.

Patents disclosing such forces applied to metal, wherein the restraining force is claimed in terms of means, or the use of means, remote from the core for retarding movement of the work will be placed originally in Class 72 only if the disclosure positively teaches deformation of the metal.

(2) With respect to unwinding, a patent wherein metal is unwound from a coil will be placed in Class 72 only if a claimed disclosure teaches deformation or stress beyond the elastic limit, as by use of a deflector* or tensioning means.

(C) CLASSES INCLUDING COMPACTING OF PARTICULATE MATERIAL:

The deformation of compacted particulate metal is not excluded from Class 72, if the work material is in self-shape-sustaining state.

The Class 72 schedule affords eight basic fields of search, as follows:

Class 72, subclasses 1- 47, and 324 -342.96 for method or apparatus including: (1) All claimed combinations of metal deforming with selected extraneous treatments (e.g., descaling, cutting) which are not, per se, excluded from the class and (2) Metal deforming with selected perfecting features (e.g., indicator, random control of stopping), which featured are deemed generally pertinent to any type of metal deforming. Class 72, subclasses 48-323, and 343-361 for method or apparatus involving selected types of metal-deforming instrumentalities (e.g., by pressurized fluent medium, by plural relatively movable work-gripping clamps).

- (1) Note. This group includes some newly defined concepts in the basic subject matter of the class for which there is no presently accepted terminology. See the Art Term Index in Subclass References to the Current Class, below, for additional entries to the schedule.

Class 72, subclasses 362-379.6 for residual metal-deforming processes (e.g., coiling or twisting) including purely manipulative steps or steps involving apparatus not provided for in preceding subclasses.

Class 72, subclasses 380- 416 for essentially complete basic apparatus of the class type. Recitation of tools or tool faces, tool-moving or guiding means, and disclosure of specific work treatment by the tools, is required for original placement in this group.

- (1) Note. A basic flat-platen press or flat-faced power hammer and anvil is excluded from this group unless the claimed combination specifically fits a subclass definition (e.g., a simple flat-platen press claimed only as a bender or straightener for specifically shaped work may possibly qualify as off-set-tool-face apparatus for subclasses 380+; otherwise it would be found in following group).
Class 72, subclasses 417-461 for apparatus subcombinations, such as tool drivers or work handling means, of insufficient scope to constitute complete metal-deforming devices; also, the flat-faced power hammers and presses noted above.

Class 72, subclasses 462- 482.94 for tools and/or tool holders.

- (1) Note. Some tools, such as a bridge-type extrusion die, are classified in preceding groups, as subcombinations peculiar to specific metal-deforming apparatus.

Class 72, subclass 483, for miscellaneous apparatus or nontool element not provided for in preceding subclasses.

Class 72, subclasses 700 - 715 for cross-referenced material relating to six concepts or commonly used terms which have not been defined for Class 72. For instance, subclasses 700 and 705 relate to particular kinds of workpieces. For these and other undefined terms, see the Art Term Index in Subclass References to the Current Class, below

ART TERM INDEX TO CLASS 72

The index in Subclass References to the Current Class, below, is provided for convenience in locating certain types of metal-deforming methods or apparatus according to key words in common usage.

Some keywords (e.g., Rolling) resemble defined Glossary terms, below, but are here used in their popular or broader (often ambiguous) sense.

Certain keywords represent subject matter formerly included in abolished classes but excluded from Class 72. Pertinent classes for such subject matter are:

Class 100, Press; Class 29, Assembling; Class 228, Welding

SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

SEE OR SEARCH THIS CLASS, SUBCLASS:

- | | | |
|--------|-----------------------|--|
| 6.1+, | 28.1+, | AUTOMATIC CONTROL (COMBINED) |
| 31.13, | 253.1+, | DIE-EXPRESSION (EXTRUSION) |
| 39+, | | DESCALING (COMBINED) |
| 51+, | 176+, | SKELPING |
| 53, | | SHOT-PEENING |
| 56, | | ELECTROHYDRAULIC FORMING |
| 56, | | ELECTROMAGNETIC FORMING |
| 56, | | EXPLOSIVE FORMING |
| 56, | | HIGH-ENERGY-RATE FORMING (SEE EXPLOSIVE FORMING, ETC.) |
| 57+, | 150, 465, | CORE, DEFORMABLE, ETC. |
| 59, | 176+, 184+, 385, 415, | CORRUGATING |

59, 62, TUBE CORRUGATING
 64+, 299, 371, TWISTING
 66, COILING
 76, 377, 395, PEENING (PEINING)
 76, 377, 465.1, SNARLING (STIPLING)
 76, 402, SWAGING
 82+, SPINNING
 82+, 293+, 350, 417, BLANKHOLDER.
 76, 402, TUBE.
 84+, 102+, 367, BEADING
 88+, PLATEN-ROLLING
 88+, 104, THREAD-ROLLING
 91+, BY WALKING-FORM, CONCAVE-AND-ROLL
 97, 256+, 325+, PIERCING
 115+, 317, AND 393, FLARING, TUBE
 115+, 317, 393, TUBE FLARING
 135+, SPRING COILER.
 135+, HELICAL COILING.
 146+, SPIRAL COILING.
 149, WIPE-FORMING.
 151, 295+, 305, STRETCH-FORMING
 160+, LEVELLING.
 184+, FLYING TOOL.
 184+, DIE-ROLLING
 186, 325+, 464, COMPOSITE (WITH CUTTING) TOOL.
 189, PILFERING MILL
 196, 402, 712, CRIMPING
 199+, 365.2+, ROLLING
 217, SWEEP-ARM.
 220, WALKING-FORM
 223, 232 ROLLING, THREE-HIGH MILL
 241.2+, ROLLING, FOUR-HIGH MILL
 256, 325+, BILLET PIERCING
 258, 700, BIMETALLIC WORK
 264+, CORE TUBE, EXTRUSION
 264+, 462+, MANDREL, EXTRUSION.
 267, COLD SQUIRTING (IMPACT EXTRUSION)
 267, IMPACT EXTRUSION.
 274+, DRAWING, DIE BENCH
 274+, 302+, 378, STRETCHING
 274+, DRAWING, WIRE- OR TUBE-
 284, 343 DRAWING, PUSH-
 292, 303, 402, SHRINKER, TIRE.
 293+, AND NOTES THEREUNDER, CUTTING (COMBINED).
 296+, WRAP-FORMING.
 298, 310, 319+, BENDING (SEE COILING, CORRUGATING, LEVELLER) BRAKE.
 301, 386+, OFFSETTING.
 302+, 318, 322+, 352+, 377, 407+, 416, UPSETTING
 318, 357, HEADING
 334, 340, TRIMMING (SEE CUTTING)

336, 337, BLANKING (SEE CUTTING)
 347+, DRAWING, DEEP- OR SHELL-
 358+, 414, EMBOSS
 359, COINING
 360, 412+, 437, DROP FORGING
 367+, TUBE WORKING
 377, FORGING (SEE SPECIFIC TERMS)
 377, REDUCING (SEE SPECIFIC TERMS)
 377, SWAGING (SEE SPECIFIC TERMS)
 389.1+, SHAFT STRAIGHTENING
 411, EDGEWISE BENDER
 419+, FEED, WORK (COMBINED)
 419+, HANDLING (COMBINED)
 429+, HAMMER, DRIVE
 430, EXPLOSIVELY ACTUATED TOOL
 435+, HAMMER, DROP
 462+, ANVIL
 462+, HAMMER
 467+, THROUGH DIE
 700, ALLOY
 700, RARE METAL
 701, 702, DISTORTION PREVENTION
 703, KNURLING
 705, FRAME STRAIGHTENING

SECTION IV - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

- 7, Compound Tools, for patented art involving metal deformation in combination with assembly of plural members.
- 29, Metal Working, for patented art involving metal deformation in combination with assembly of plural members, and subclass 700 under "SEARCH CLASS" (and see reference to other classes in (5) Note).
- 29, Metal Working, subclasses 284 through 25.42, inclusive; and subclasses 592+ particularly 592.1 through 899.1, inclusive. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 29, Metal Working, especially subclasses 270+ providing for hand-manipulatable tool means. (class providing for a tool or toolface, per se)
- 29, Metal Working (e.g., residual for fibrous material), for claimed disclosure of deformation of a nonmetal only.
- 57, Textiles: Spinning, Twisting, and Twining, for patented art involving metal deformation in combination with assembly of plural members, subclass 9 and 311 involving preforming of wire strands.

- 59, Chain, Staple, and Horseshoe Making, for patented art involving metal deformation in combination with assembly of plural members.
- 59, Chain, Staple, and Horseshoe Making. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 60, Power Plants, for patents claiming a means for driving a tool, which tool is recited by name only (both in the claim(s) and in the specification).
- 74, Machine Element or Mechanism, for patents claiming a means for driving a tool, which tool is recited by name only (both in the claim(s) and in the specification).
- 76, Metal Tools and Implements, Making, for patented art involving metal deformation in combination with assembly of plural members.
- 76, Metal Tools and Implements, Making. (directed to the manufacture of particular products)
- 79, Button Making, subclass 3. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 81, Tools, especially subclasses 300+ providing for plier-type tool structure. (class providing for a tool or toolface, per se)
- 83, Cutting, especially subclasses 651+ providing for cutting tool or tool-support structure. (class providing for a tool or toolface, per se)
- 100, Presses, subclasses 214+ having disclosures of reciprocating press construction wherein the tool is a platen. See this class (100) for patents claiming a means for driving a tool which tool is recited by name only (both in the claim(s) and in the specification).
- 140, Wireworking, subclasses 71 through 92.2, inclusive; and subclasses 3 through 57, inclusive. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 144, Woodworking, , for claimed disclosure of deformation of a nonmetal only.
- 156, Adhesive Bonding and Miscellaneous Chemical Manufacture, , for claimed disclosure of deformation of a nonmetal only.
- 157, Wheelwright Machines, for patented art involving metal deformation in combination with assembly of plural members.
- 163, Needle and Pin Making. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 173, Tool Driving or Impacting, having disclosures of a motion converting means and/or hammer for driving a general-purpose tool. See this class (100) for patents claiming a means for driving a tool which tool is recited by name only (both in the claim(s) and in the specification).
- 193, Conveyors, Chutes, Skids, Guides, and Ways, except that a chute or other gravity conveyor combined with a power-driven conveyor is found in Class 198, Conveyors: Power-Driven, subclass 311, 359+, 523+, and others. (class directed to work-handling or product-handling)
- 198, Conveyors: Power-Driven, particularly subclasses 373+ for a conveyor having means for changing the attitude of the conveyor load relative to the conveying direction. (class directed to work-handling or product-handling)
- 209, Classifying, Separating, and Assorting Solids. (class directed to work-handling or product-handling)
- 219, Electric Heating (for combination of metal deforming and electric welding), for patented art involving metal deformation in combination with assembly of plural members.
- 226, Advancing Material of Indeterminate Length. (class directed to work-handling or product-handling)
- 227, Elongated-Member-Driving Apparatus, for patented art involving metal deformation in combination with assembly of plural members.
- 228, Metal Fusion Bonding, for patented art involving metal deformation in combination with assembly of plural members.
- 242, Winding, Tensioning, or Guiding, (also see the reference to Class 242 in OTHER CLASS RELATIONSHIPS, above). (class directed to work-handling or product-handling)
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, , for claimed disclosure of deformation of a nonmetal only.
- 271, Sheet Feeding or Delivering. (class directed to work-handling or product-handling)
- 294, Handling: Hand and Hoist-Line Implements. (class directed to work-handling or product-handling)
- 310, Electrical Generator or Motor Structure, for patents claiming a means for driving a tool, which tool is recited by name only (both in the claim(s) and in the specification).
- 405, Hydraulic and Earth Engineering, subclasses 232+ having disclosures of pile-driver means, for patents claiming a means for driving a tool, which tool is recited by name only (both in the claim(s) and in the specification).

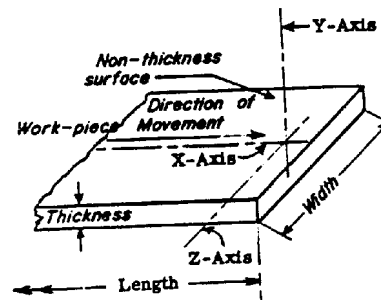
- 414, Material or Article Handling, in particular subclasses 754+ where billet turnover devices can be found and compare with those devices in Class 198, Conveyors: Power-Driven, subclasses 373+. (class directed to work-handling or product-handling)
- 419, Powder Metallurgy Processes, appropriate subclasses for processes of forming articles from particulate material including metal particles with or without use of heat.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, for claimed disclosure of deformation of a nonmetal only..
- 470, Threaded, Headed Fastener, or Washer Making: Process and Apparatus, appropriate subclasses for methods and machines for making bolt, screws, nuts, nails, rivets, and washers. (directed to the manufacture of particular products, see Classes of Article Making, above)
- 475, Planetary Gear Transmission Systems or Components, for patents claiming a means for driving a tool, which tool is recited by name only (both in the claim(s) and in the specification).
- 470, Threaded, Headed Fastener, or Washer Making: Process and Apparatus, for patented art involving metal deformation in combination with assembly of plural members, appropriate subclasses for methods and machines for making bolt, screws, nuts, nails, rivets, and washers.
- 493, Manufacturing Container or Tube From Paper; or Other Manufacturing From a Sheet or Web, for claimed disclosure of deformation of a non-metal only.

objects) and/or joining said preforms, i.e., so treating one or more of them as to restrict their relative mobility.

- (1) Note. The mere ordering, stacking, or piling of workpieces prior to a metal-deforming operation thereupon, or the similar handling of products, is not regarded as "Assembly" for the purposes of this class.

AXIS-OF-BEND

That imaginary line used as a center about which the bending of moving work occurs. For convenience in illustrating the application of the term to the deformation of planiform work, three such axes may be considered, all being related to the direction of work movement and to the disposition of a planar nonthickness surface (see Figure III-1). The three axes are defined as follows:



(A) X-Axis is a line both parallel to the direction of movement of the work and parallel to a nonthickness surface thereof.

(B) Y-Axis is a line both perpendicular to the direction of movement of the work (i.e., length) and perpendicular to a nonthickness surface thereof.

(C) Z-Axis is a line both perpendicular to the direction of movement of the work and parallel to a nonthickness surface thereof.

In the case of strand or rodlike work (i.e., wherein a cross section taken transverse to its length shows substantially equal width and thickness), corresponding or analogous axes are used for convenience.

Figure III-2 shows the product partially bent around a Z-Axis to form a transverse bend or the first convolution of a spiral coil.

SECTION V - GLOSSARY

ANVIL

An undriven tool which, as disclosed, is designed and intended to react against work with sufficient force to enable an operation of the class type to be effected in some portion of the work.

- (1) Note. An undriven flat-faced tool is regarded as an "Anvil", even though work of a specific shape may be deformed into flatness against it.

ASSEMBLY

The act or operation of bringing into juxtaposition or contact a plurality of preforms (self-shape-sustaining

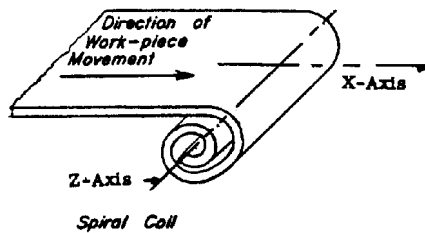


Figure 111-3 shows the product bent around a Z-Axis and additionally deflected along the Z-Axis-of-Bend, to form a helical-coil from rod.

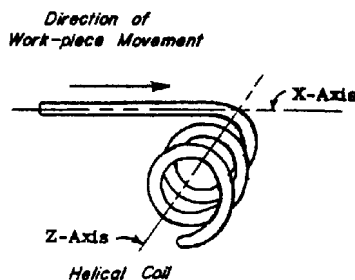


Figure III-4 shows the operation termed "levelling" wherein each successive work portion is deflected in alternation about a plurality or parallel Z-Axes, whereby each portion travels through an undulating path.

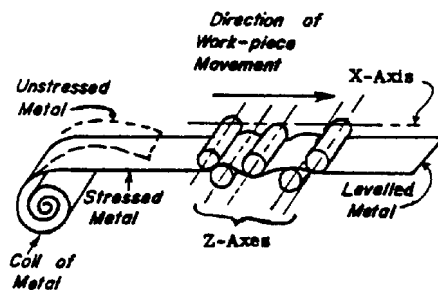
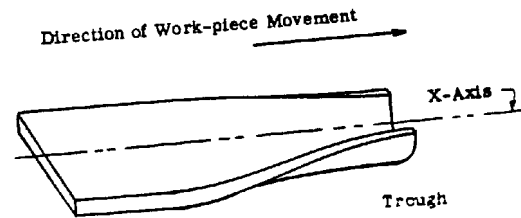


Figure III-5 shows the side margins of the work bent around the X-Axis to form a trough. Further bending of the side margins obviously form a tube.



BLANK

A discrete piece of material which is intended to be subjected to an operation of the class type.

BLANK HOLDER

A mechanism, incorporated in a metal-deforming device, intended to grip a blank prior to and during deformation thereof. (Often arranged to permit a desired amount of slippage of said blank in response to the application of deforming force thereto, thereby modifying the effect of the metal-deforming tools). See "Clamp".

CAVITY

(DIE CAVITY) A passageway closed at one end; a chamber or blind hole having at least one work-shape-imposing portion of closed perimeter definable in a plane normal to the direction of relative motion of a co-acting tool or work forcer, or of the disclosed flow of work. See "Orifice" and "Passageway".

CLAMP

(See "Work-Gripping Clamp" and compare "Blank Holder").

CLEAN

To loosen, separate, or remove from the surface of metal a spot or layer of any substance generally distinguishable from the work material without intended redimensioning of said material.

CLOSED DIE

A tool* which comprises a work-shape-imposing orifice*, cavity*, or passageway*. (See diagrams under subclasses 276, 327, 350, and 360 for examples of "Closed Die").

COIL

The product of an operation in which work is bent so that it surrounds an Axis-Of-Bend* through more than 360 degrees of revolution. As used in this class, the operation involves moving the work and progressively deflecting successive portions thereof in the same general direction which is arcuate with respect to the direction of movement of the work.

- (1) Note. To produce a SPIRAL-COIL, the work is bent by deflection and wound, one convolution on a successive convolution, to form a scroll of gradually increasing diameter.
- (2) Note. To produce a HELICAL-COIL, the work is deflected as described above, but an additional deflection or diversion is imposed on successive convolutions. The additional deflection is directed along the Axis-Of-Bend*. The additional component of bend is measured in terms of pitch, which term is used here in the same sense as applied to a screw or helix.

CONTROL

To start, or to modify the operating condition of, any portion of a work-treating or handling device

- (1) Note. "Stopping" is ordinarily regarded as an aspect of "Control", but is separately treated in this class in accordance with the class schedule. See subclasses 1+.

CUT

To separate any portion of a workpiece from any other portion of the same workpiece by a step of machining (e.g., grinding, drilling, boring, milling, planing), severing (e.g., breaking, sawing, slicing, shearing), or by intrusion of a sharp-edged or pointed tool without removal of material (e.g., stabbing, splitting, intrusive punching). See "Sever" and "Pierce".

DEFLECTOR

An element of instrumentality which engages successively presented portions of moving work and forces said portions from a first path of motion into a second and different path of motion.

- (1) Note. The "Deflector" may comprise a single deflecting surface forcing all portions of work in a single direction, or a plurality of elements acting differently upon different portions of work.

DIE

A metal-deforming tool* which, as disclosed, has a shaping or reshaping function with regard to the portion(s) of work engaged by it.

- (1) Note. For the purposes of this class, a "Die" may be regarded as a tool which leaves or impresses its characteristic mark on the engaged face portion of work. The mark may be a three-dimensional imprint of the die face (see "Tool Face"), or may simply be the trace or track left by passage of the "Die" while in forcible engagement with the work, with or without accompanying deformation in other portions of the work. If the tool-engaged face of the work remains unaltered in shape or position, the tool is regarded as an anvil*; if altered in position only, the tool in question is a work-forcer*. See "Anvil", "Closed Die". "Tool", and "Work- Forcer".

FLYING TOOL

A tool*, other than a roller, having a tool face which, as disclosed, engages and acts upon bodily moving work while itself moving substantially in the same direction and at the same speed as such work.

HOLLOW WORK

Material or article of indeterminate length having exterior and interior surfaces extending in the length dimension; each surface, as viewed in a cross section normal to the length dimension, showing an unbroken periphery; the interior surface of which is intended to be treated by a metal-deforming tool of limited length.

METAL

The material subjected to an operation of the class type; an elemental metal or alloy of mixture thereof in self-shape-sustaining state (i.e., not molten, gaseous, or powdered); metal as the term is employed in Class 29, Metal Working, and Class 148, Metal Treatment.

ORIFICE

A closed perimeter opening or aperture extending directly through the thickness of a plate or wall and constituting (1) the mouth of a chamber, or (2) an interconnection between the regions of space at either side of a plate or wall of substantial lateral extent. A passageway* of such short length that it has only one effective work-shape-imposing portion.

PASSAGEWAY

A conduit or path (especially for guiding and restraining the plastic flow of metal), having at least one shape-imposing portion of closed perimeter definable in a plane normal to the axis of the conduit.

- (1) Note. A passageway is usually open at each end; the term may, however be applied to a blind hole which, by disclosure, does not become completely and forcibly filled with work during an operation of the class type.
- (2) Note. A passageway is capable of imposing more than one shape on work; it may be regarded as a sequence of orifices, e.g., for drawing or extruding a twisted product of noncircular cross section.

PIERCE

To stab or penetrate by a pointed, conical, or wedgelike tool, as distinguished from punching (shearing) by coacting-edged tools.

PLURAL TOOL SET

Three or more relatively movable tools* which are effective in any combination to perform operations of the class type on one or more discrete pieces of work, of which tools less than the total number are in actual contact with the same piece of work at the same time. For example: (1) tool couples* located at spaced tool stations in a plural tool station machine, if they act on distinct workpieces, or noncurrently on portions of integrally connected work material, and (2) two movable tools alternately engaging a workpiece resting upon an anvil, each tool retracting before the other tool touches the work.

PRODUCT

The object or material after an operation of the class type has been performed thereon.

- (1) Note. The "Product" of one operation is properly denoted as "Work" for a subsequent operation.

ROLLER

A deforming instrumentality having a work-engaging, work-deforming peripheral surface which is generated by a line revolving about an axis, said instrumentality being disclosed as revolving about said axis so that successive peripheral portions thereof cyclically move into and out of contact with a work surface during deformation of the work, relative movement occurring, during deformation, between said axis and the work surface along a direction parallel to the work surface, thereby producing a relative rolling motion between the roller surface and the work surface as contrasted with sliding motion (i.e., the surfaces move in the same direction at substantially the same linear speed).

- (1) Note. The generating line of the peripheral surface may have any continuous profile (e.g., straight, curved, or irregular), and the line may have any desired inclination, other than at right angles, relative to the axis. Thus, to be considered a "Roller", any and all cross sections taken at right angles to the axis must show a circular work-engaging periphery.
- (2) Note. A hollow member wherein the interior surface is generated and used as described is also considered to be a "Roller".
- (3) Note. A plurality of tools rotatable about the same axis in the same direction and at the same rotational speed is considered to be a single "Roller" in the environment described herein.

ROLLER CLUSTER

A group of three or more rollers* disposed relatively to one another and to the work* such that the work passes between the rollers with a peripheral surface portion of each roller engaging a surface portion of the work, the engaged surface portions being substantially coextensive in the direction of movement of the work, and the rollers simultaneously deforming the work.

ROLLER COUPLE

A group of two coacting rollers* disposed opposite one another such that work passes therebetween, the adjacent peripheral surfaces of both rollers simultaneously engaging opposite sides, or opposed surfaces portions, of the work passing between the rollers and thus deforming that work.

ROLLER-LIKE TOOL

A deforming instrumentality having a work- engaging, work-deforming tool surface with some, but not all, of the characteristics of a roller*.

- (1) Note. Usually (a) the surface is generated by a line revolving about an axis (thus the tool looks like a roller), but the relative movement of the axis and work produces a sliding motion of tool surface relative to work surface; or (b) the relative movement of the tool axis and the work produces a rolling motion of tool surface on work surface (thus the tool acts like a roller), but the surface is not formed as a roller (e.g., the tool surface is rough, or gearlike, or recessed).

SEVER

To forcibly part or separate a discrete portion from a body of material. See "Cut".

STOCK

A piece or an indeterminate length of material from which a plurality of blanks* or products* may be made (usually in linear sequence).

TOOL

A tangible instrumentality having a surface portion which is designed and intended to engage or react against work with sufficient force to effect an operation of the class type.

- (1) Note. A core, mandrel, anvil, or the like, which may be "passive" in the sense of supplying only reaction force is included in this definition. The tool may be either transitory or enduring; it may be destroyed in a single use.

TOOL CARRIER

A device for holding a tool* (a) against the force of gravity, and/or (b) in cooperative relationship with another tool(s) or the work, and wherein the tool moves with respect to the device. For example, a stationary axle on which a roller* rotates is a "Tool Carrier" because of the relative movement; however, a shaft to which a roller is keyed so that both rotate together is not a carrier, whereas the bearing in which the shaft rotates is a "Tool Carrier" in this instance.

TOOL COMPLEX

Three or more relatively movable tools* which are in simultaneous contact with the same work at some instant during a metal-deforming operation.

- (1) Note. Typically, either all active tools are concurrently actuated, or a tool couple deforms work and remains in contact therewith while a third, fourth, etc., tool advances into deforming contact with the thus restrained work.
- (2) Note. The deformation effected by a "Tool Complex" is generally greater in degree and/or more elaborate in detail than can be accomplished by repeated operations of a tool couple*, or the successive strokes of a plural tool set*.
- (3) Note. A "Tool Complex" may accomplish two or more seemingly distinct operations (e.g., simultaneously flanging opposite edges of a sheet). In many such instances, some advantage is gained over the use of plural tool sets (e.g., balanced forces on work may permit the use of lighter clamping structure or the elimination of a work-holding device, and the simultaneous tool actions may enable closer control of dimensions).

TOOL COUPLE

Two tools which are so related in position and relative motion that when both are engaged with the same work they cooperate to effect an operation of the class type. See "Tool Complex".

TOOL FACE

The surface portion(s) of a tool body which actually engage work at some time during an operation of the class type.

- (1) Note. "Tool Face" is distinguishable from supporting, interconnecting, spacing, or surrounding surface portions which do not engage work during normal or disclosed operation. Disclosure of the tool operation is thus necessary for identification of the "Tool Face" proper, as is consideration for placement in subclasses 380+ (offset tool faces) or subclasses 392+ (relatively receding tool faces). (See diagram under subclass 386 for example of a "Tool Face".)

TOOL HOLDER

A Device rigidly attached to a tool and effective to support and/or to transmit actuating force thereto. See "Tool Carrier".

TUBE

A pipe, hollow cylinder, or hollow rodlike member consisting of a wall shaped in the form of a simple closed curve and extending axially, providing a conduit throughout its length. The wall may vary along its axial length in transverse dimensions and/or shape.

WORK

The object or material which is intended to be subjected to an operation of the class type. See "Blank".

WORK-FORCER

A driven tool which, as disclosed, has the function of forcibly moving work against the resistance of another tool.

- (1) Note. If the tool also directly deforms the engaged face of the work, it is specifically a die*.

WORK-GRIPPING CLAMP

An instrumentality having a plurality of opposed solid jaws or surface elements which are made effective, by movement of one or more of said jaws or surface elements, to grip a portion of work frictionally and to hold it fixedly.

- (1) Note. Some form of clamp-actuating means is required; a so-called "self-gripping" clamp, which closes upon work in response to initial movement of work, is included.
- (2) Note. Blank holders or "clamps", which are intended to allow controlled slippage of work during an operation, are excluded, as constituting "Tools". See "Blank Holder".

WORK TREATMENT

Altering or actively maintaining some property, characteristic, or condition of work. (Orientation or location of work, or juxtaposition of plural pieces, is not considered to be a property, characteristic, or condition for the purpose of this definition in this class).

SUBCLASSES

1 WITH RANDOMLY ACTUATED STOPPING:

This subclass is indented under the class definition. Subject matter comprising apparatus including, or method employing, means capable of bringing to a halt any or all of the moving parts of a metal-deforming instrumentality, such means acting in response to a condition or signal or impulse whose time of occurrence cannot be predicted.

- (1) Note. Disclosure of a machine capable of stopping will not be placed here as an original unless a claim particularly recites such stopping as a result of an unplanned or unpredictable occurrence.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 14.3, and 21.3, for a disclosure wherein a machine, or a part thereof, stops in response to a tool sensor.
- 30.1+, for a disclosure wherein a machine, or a part thereof, stops when an intended operation has been completed, and see (1) Note above.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 58 for stopping means in a cutting machine, wherein the stopping means, per se, is similar to those of this and indented subclasses.

192, Clutches and Power-Stop Control, for stopping means in general; and subclass 134 for stopping of a machine responsive to part of an operative's body.

234, Selective Cutting (e.g., Punching), subclass 30 for selective cutting means provided with randomly actuated stopping means.

2 **Manually controlled:**

This subclass is indented under subclass 1. Subject matter wherein the halting of instrumentality operation is the direct result of a willful act of an operative.

(1) Note. The term "manual" includes the use of any part of the body of the operative.

3 **Responsive to condition of work or product:**

This subclass is indented under subclass 1. Subject matter wherein the halting of instrumentality operation results from the sensing of a property or state of the work* or product*.

(1) Note. The term "property or state" includes shape, size of presentation such as feed, presence, absence, or attitude of the work or product.

4 **Work feed or faulty work:**

This subclass is indented under subclass 3. Subject matter wherein the sensed property or state is an abnormality in the work itself or in the presentation of work to the machine, or an exhaustion in the supply of work.

5 **Termination or tangle of running length work:**

This subclass is indented under subclass 4. Subject matter wherein the work moves along a direction coinciding with its dimension of greatest magnitude, and wherein the sensed property or state is either (a) an interruption in work movement (caused by breakage or exhaustion thereof), or (b) a snarl or kink in the work.

6.1 **WITH USE OF CONTROL MEANS ENERGIZED IN RESPONSE TO ACTIVA-**

TOR STIMULATED BY CONDITION SENSOR:

This subclass is indented under the class definition. Subject matter including means, or a step of using means, for (a) detecting any of the following characteristics: a state or property, a change in a state or property, or the occurrence of a predetermined event, in any of the following: the work*, the product of a machine, the machine itself, any part of the machine, or the environment of the machine affecting the operation thereof, (b) initiating (as a direct result of such detection) a force or impulse other than that generated or transmitted by the detecting means, and (c) regulating or modifying (as a direct result of such initiation) the operation of said machine.

(1) Note. This definition requires a patent to claim at least four instrumentalities (or the use thereof) for original placement herein. One of these must be a metal-deforming machine or a device (e.g., work feeder, work heater, product handler) necessary to the proximate function of deforming metal. The other three are (a) a sensor (e.g., photocell system, trip lever, pressure diaphragm) to detect a condition as stated in (a) of the definition, (b) an activator (e.g., an element to make or break an electric circuit, a clutch, a valve) to cause a release of energy more than, or different from, that accounted for by mere change in condition (e.g., position or movement) of the sensor while it is functioning, and (c) a controller (e.g., a motor or driver for said machine or device) to change or cause the operation of said machine or device. Therefore, a cam follower (or sensor) directly linked to a controller, whereby follower movement directly effects controller movement, is not proper subject matter for this subclass due to lack of an activator as defined. On the other hand, disclosure of a cam follower that makes and breaks an electrical circuit that energizes a motor, may be placed herein.

(2) Note. A voluntary act of the person operating the machine is not proper subject matter for this subclass. For example, disclosure of an on/off switch on a metal-deforming machine manipulated

by an operative to start and/or stop the machine (even though the switch initiates a release of energy), should be considered for subclass 1, but is not classified herein.

- (3) Note. The machine that is regulated by the control means is not limited to a work deforming machine of this class. It can be another machine associated with the work deformer if the claim reciting the other machine and work deformer is acceptable for original placement into Class 72.
- (4) Note. The control system disclosed in the patents of this and indented subclasses are similar in concept to control systems of other classes, particularly Class 226, Advancing Material of Indeterminate Length, and Class 83, Cutting. The total operations and the claimed combinations are, of course, different, but the control systems, per se, found in Classes 226 and 83 are usually analogous to those herein, and may be applicable to the machines of Class 72. In the "SEARCH CLASS" notes for the subclasses indented hereunder, reference to this (4) Note indicated that the other class and subclass should be considered because the control system, per se, of a patent in the other class may be similar to a control system, per se, of Class 72. The notes to Class 83, subclass 399 (which see), summarize all the subclasses in Class 83 pertaining to "control" subclasses therein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 1+, for metal deforming with randomly actuating stopping, and see (2) Note above.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 72+ for a cutting machine with means to monitor and control that machine.
- 226, Advancing Material of Indeterminate Length, and see (4) Note above.

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 135+ for apparatus to shape or reshape nonmetals combined with control means responsive to, or actuated by, means sensing or detecting a condition; see the search notes thereunder.

6.2 Metal deforming by use of roller or roller-like tool element:

This subclass is indented under subclass 6.1. Subject matter comprising a machine including, or method employing, a roller* tool or a roller-like tool* to deform work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 28.2+, and 30.2, for other deforming by a roller or roller-like tool including control of the tool.
- 67+, for deforming by relative rotation between a workpiece and a tool, particularly subclass 75 for a spherical tool, subclasses 91+ for deforming by a roller or roller-like tool cooperating with an opposing concave surface, subclasses 110+ for a roller cluster, and subclass 124 for a roller cooperating with a work-spaced tool.
- 127+, for deflecting to deform metal which may include use of a roller or roller-like tool, particularly subclasses 162+ for "levelling" by use of relatively-inclined successive rollers, subclasses 178+ for "troughing" by use of a roller cluster, subclasses 179+ and 182 for use of a roller couple.
- 184+, for deforming by a "flying tool" that may comprise a roller or roller-like tool.
- 199+, for deforming by a roller or roller-like tool, generally.
- 366.2, for a method of deforming by a disclosed (but not claimed) roller.

SEE OR SEARCH CLASS:

- 228, Metal Fusion Bonding, subclass 158 for rolling of metal parts combined with independent fusion bonding of the parts; and subclass 243 for simultaneous rolling and fusion bonding of the parts.

425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 363+ for a press forming or press reshaping means for nonmetal including an endless (e.g., roll, etc.) forming surface.

7.1 Including use of sensor responsive to information carried by removable auxiliary record (e.g., recording disk, tape, or card):

This subclass is indented under subclass 6.2. Subject matter including using a separate device inserted into, attached to, or applied to, the machine, and detecting physical characteristics of the device to control the operation of the machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14.8+, for a sensor which regulates a removable auxiliary record to responsively regulate a deforming machine other than one which deforms by a roller or roller-like tool.

SEE OR SEARCH CLASS:

66, Textiles: Knitting, subclasses 215+ for knitting by use of a pattern-responsive control means which may be removable from a knitting device.
83, Cutting, subclasses 76.1+, for cutting with use of a control means responsive to a replaceable information program. Also, see (4) Note under the definition of Class 72, subclass 6.1.
139, Textiles: Weaving, subclasses 317+ for pattern-responsive control means.
226, Advancing Material of Indeterminate Length, subclass 9, and see (4) Note under the definition of Class 72, subclass 6.1.

7.2 Including plural sensors or sensor responsive to comparison between plural conditions:

This subclass is indented under subclass 7.1. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics; in either case, then comparing the characteristics and generating a resultant impulse representing the similarities or differences between the detected characteristics, whereby

the regulating means governs the machine in accordance with the resultant impulse to correct incipient errors in the machine or to maintain operation of the machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.1+, 14.9+ and 16.1+, for other metal deforming including multiple sensing with comparison of impulses from the sensors.
11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing but without comparison of impulses from the sensors.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 72+ for “self-regulating” or “feedback” control means, and see (4) Note under the definition of Class 72, subclass 6.1.

7.3 Sensing “pattern”:

This subclass is indented under subclass 7.2. Subject matter including using a contoured guide engaged by a traversing follower connected to a metal deforming tool such that the tool follows a path identical to the contours of the guide as the tool engages the work for deformation thereof.

(1) Note. The term “pattern” (in the title) refers to a model or prototype insertable into and removable from the machine and having a shape or configuration exactly similar or proportional to the shape or configuration of the desired product. A cam or eccentric or other object which is distorted with respect to the desired product is not considered to be a pattern, and disclosures of such objects may be found in other subclasses appropriate to the deformer.

SEE OR SEARCH THIS CLASS, SUBCLASS:

15.1, for a removable pattern to be used in a condition responsive control means of metal deforming means, generally.
82, for deforming of a rotating workpiece by use of a “pattern” that causes tool movement without a control means energized in response of an activator.

7.4 Sensing work or product (e.g., by X-ray):

This subclass is indented under subclass 7.2. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.

- (1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.
- (2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.3+, 11.1+, 15.1+, 16.2+, and 17.3+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.
- 226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

7.5 Sensing lead end or tail end:

This subclass is indented under subclass 7.4. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.8, 11.5, 12.5, 15.4, 16.7, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

7.6 Sensing cross sectional dimension:

This subclass is indented under subclass 7.4. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.9+, 11.6+, 12.7+, 15.5, 16.8+, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

8.1 Including plural sensors or sensor responsive to comparison between plural conditions:

This subclass is indented under subclass 6.2. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics; in either case, then comparing the characteristics and generating a resultant impulse representing the similarities or differences between the detected characteristics, whereby the regulating means governs the machine in accordance with the resultant impulse to correct incipient errors in the machine or to maintain operation of the machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 7.2+, 14.9+ and 16.1+, for other metal deforming including multiple sensing with comparison of impulses from the sensors.
- 11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing but without comparison of impulses from the sensors.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 72+ for “self-regulating” or “feedback” control means, and see (4) Note under the definition of Class 72, subclass 6.1.

8.2 Sensing “memory” stored on tool or tool-linked part:

This subclass is indented under subclass 8.1. Subject matter including use of structure having an impressible media capable of holding data which is part of the instrumentality for

engaging the work for deforming, or is fixedly attached thereto.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

15.1+, for sensing “memory” stored on a tool or tool-linked part to regulate a metal deforming machine that does not use a roller or roller-like tool.

8.3 Sensing work or product (e.g., by X-ray):

This subclass is indented under subclass 8.1. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.

(1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.

(2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.4+, 11.1+, 15.3+, 16.2+, and 17.3+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.

226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

8.4 Work and product:

This subclass is indented under subclass 8.3. Subject matter including detecting a characteristic of the work* for the machine and detecting a characteristic of the product* of the same machine.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

16.4, and 18.2, for other sensing of both work and product.

8.5 Sensing temperature:

This subclass is indented under subclass 8.3. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

11.3, 12.2, 16.5, 18.3, and 19.1, for other sensing of temperature.

8.6 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 8.3. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

(1) Note. A typical disclosure found in this subclass comprises a system including two rolling mills through which the work passes sequentially. In the space between the rolling mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line indicates the tautness of the work passing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

11.4, 12.3, 16.6, 18.4, and 19.2, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

8.7 Measuring tension distribution across width of work:

This subclass is indented under subclass 8.6. Subject matter including detecting the degree of tautness in an elongated workpiece at different lateral locations perpendicular to the length of the workpiece.

8.8 Sensing lead end or tail end:

This subclass is indented under subclass 8.3. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.5, 11.5, 12.5, 15.4, 16.7, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

8.9 Sensing cross sectional dimension:

This subclass is indented under subclass 8.3. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., "X-ray") detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.6+, 11.6+, 12.7+, 15.5, 16.8+, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

9.1 Sensing flatness (e.g., crown):

This subclass is indented under subclass 8.9. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the planar characteristic of one of the greater surfaces.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

11.7, and 18.7, for other sensing of flatness, used to regulate the operation of a metal deforming machine.

9.2 Sensing thickness:

This subclass is indented under subclass 8.9. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the extent of the lesser dimension.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

11.8+, 16.9 and 18.8, for other sensing of work thickness to control a metal deforming machine.

9.3 Of edge of work or product:

This subclass is indented under subclass 9.2. Subject matter including detecting to discern the extent of the lesser dimension near the lateral margin of the work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

11.9, for other sensing of the edge of a workpiece.

9.4 Sensor utilizes radiation to detect thickness (e.g., by X-ray):

This subclass is indented under subclass 9.2. Subject matter including use of a source of radiation and a detector responsive to that radiation to determines the extent of the lesser dimension by the amount of radiation reaching the detector.

9.5 Sensing tool or tool-linked part:

This subclass is indented under subclass 8.3. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this subclass requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

10.1+, 12.1, 13.4+, 17.1, 17.2, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.

- be responsive to condition at one of the roll chocks (bearings).
- 10.1 Sensing tool or tool-linked part:**
This subclass is indented under subclass 8.1. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.
- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
9.5, 12.1, 13.4+, 17.1, 17.2, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.
- 10.2 Sensing torque:**
This subclass is indented under subclass 10.1. Subject matter including used of detecting means which discerns rotational force applied to the tool or tool-linked part.
- 10.3 Sensing roll rotation (e.g., speed or distance):**
This subclass is indented under subclass 10.1. Subject matter including detecting movement of the roll about its axis.
- 10.4 Sensing force:**
This subclass is indented under subclass 10.1. Subject matter including detecting the pressure applied to the tool or tool-linked part.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
14.4+, and 21.4+, for other sensing of force.
- 10.5 By sensor along roll surface and another sensor along roll axis:**
This subclass is indented under subclass 10.4. Subject matter including use of a first detecting means responsive to a condition of a work engaging portion of the rolling tool and including use of a second detecting means along the rotational axis of the rolling tool.
- (1) Note. The second detecting means of this subclass may also be responsive to a work engaging portion of the roll or may
- 10.6 By sensing hydraulic pressure applied to roll:**
This subclass is indented under subclass 10.4. Subject matter wherein force is effected on the rolling tool by hydraulic pressure, and wherein the sensor is responsive to that hydraulic pressure.
- 10.7 Sensing roll gap:**
This subclass is indented under subclass 10.1. Subject matter including detecting the location of the tool with respect to the cooperating tool, to thereby establish the size of the work passage between the tools.
- 10.8 Requiring operative intervention (e.g., for safety):**
This subclass is indented under subclass 6.2. Subject matter in which action by a person necessary for the subject matter to operate.
- 10.9 With pause awaiting input from operative:**
This subclass is indented under subclass 10.8. Subject matter including terminating a portion of the operation until a stimulation is made by a person operating the subject matter.
- 11.1 Sensing work or product (e.g., by X-ray):**
This subclass is indented under subclass 6.2. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.
- (1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.
- (2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
7.4+, 8.3+, 15.3+, 16.2+, and 17.3+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.
- 226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

11.2 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 11.1. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received. See (1) Note, above.
- 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

11.3 Sensing temperature:

This subclass is indented under subclass 11.2. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 8.5, 12.2, 16.5, 18.3, and 19.1, for other sensing of temperature.

11.4 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 11.2. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

- (1) Note. A typical disclosure found in this subclass comprises a system including two rolling mills through which the work passes sequentially. In the space between the rolling mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line indicates the tautness of the work passing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 8.6+, 12.3, 16.6, 18.4, and 19.2, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

- 226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

11.5 Sensing lead end or tail end:

This subclass is indented under subclass 11.2. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.5, 8.8, 12.5, 15.4, 16.7, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

11.6 Sensing cross sectional dimension:

This subclass is indented under subclass 11.2. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., "X-ray") detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.6+, 8.9+, 12.7+, 15.5, 16.8+, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

11.7 Sensing flatness (e.g., crown):

This subclass is indented under subclass 11.6. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the planar characteristic of one of the greater surfaces.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.1, and 18.7, for other sensing of flatness, used to regulate the operation of a metal deforming machine.

11.8 Sensing thickness:

This subclass is indented under subclass 11.6. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting means discerns the extent of the lesser dimension.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.2+, 16.9, and 18.8, for other sensing of work thickness to control a metal deforming machine.

11.9 Of edge of work or product:

This subclass is indented under subclass 11.8. Subject matter including detecting to discern the extent of the lesser dimension near the lateral margin of the work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.3, for other sensing of the edge of a workpiece.

12.1 Sensing tool or tool-linked part:

This subclass is indented under subclass 11.2. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.5, 10.1+, 13.4+, 17.1, 17.2, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.

12.2 Sensing temperature:

This subclass is indented under subclass 11.1. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.5, 11.3, 16.5, 18.3, and 19.1, for other sensing of temperature.

12.3 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 11.1. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

- (1) Note. A typical disclosure found in this subclass comprises a system including two rolling mills through which the work passes sequentially. In the space between the rolling mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line indicates the tautness of the work pass-

ing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.6+, 11.4, 16.6, 18.4, and 19.2, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

12.4 With deforming of work by sensor:

This subclass is indented under subclass 12.3. Subject matter wherein the detector engages the work with sufficient force to stress the work beyond its elastic limit.

12.5 Sensing lead end or tail end:

This subclass is indented under subclass 11.1. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.5, 8.8, 11.5, 15.4, 16.7, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

12.6 Including sensor responsive to infeed or outpuller:

This subclass is indented under subclass 11.1. Subject matter including sensing the device for causing material to move into or away from the metal deforming device.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

19.5, for metal deforming responsive to an infeed or outpuller, generally.

12.7 Sensing cross sectional dimension:

This subclass is indented under subclass 11.1. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

(1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or

radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.6+, 8.9+, 11.6+, 15.5, 16.8+, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

12.8 To control operation of deformer directly by sensor:

This subclass is indented under subclass 12.7. Subject matter including use of a detector means, an initiator, and a regulator which governs or causes the operation of the metal deforming device as the immediate result of detecting the lateral extent of the work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

19.7, for a metal deforming machine, generally, controlling the cross sectional dimension of the work or product directly by the sensor.

13.1 Including use of sensor responsive to energy input to tool or tool driver:

This subclass is indented under subclass 6.2. Subject matter including detecting a variation in the power required to drive a deforming tool*.

(1) Note. Compare the subject matter of this subclass with that of subclasses 28.1+. A patent for these subclasses discloses a detecting means (e.g., a solenoid in this subclass or a pressure-responsive diaphragm in the indented subclass 20) that discerns an overload or change in load of electrical or hydraulic pressure, whereas a patent for subclasses 28.1+ lacks a clearly evident detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

19.8+, for a metal deforming machine, generally, including use of a sensor responsive to energy input to the tool or tool driver.

28.1+, for a metal deforming machine, generally, and a self regulating control system utilizing electrical or hydraulic energy. See (1) Note above.

13.2 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 13.1. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received.
11.2+, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

13.3 Sensing pressure of tool actuating fluid:

This subclass is indented under subclass 13.1. Subject matter wherein the tool is driven by a pneumatic or hydraulic system including detecting the force per unit of area in that system.

- (1) Note. Compare the subject matter of this subclass with that of subclasses 28.2+. A patent for these subclasses discloses a detecting means (e.g., a solenoid in this subclass or a pressure-responsive diaphragm in the indented subclass 20) that discerns an overload or change in load of electrical or hydraulic pressure, whereas a patent for subclasses 28.1+ lacks a clearly evident detecting means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

28.2+, for a metal deforming machine that uses a roller or roller-like tool and a self regulating control system utilizing electrical or hydraulic energy. See (1) Note above.

13.4 Sensing tool or tool-linked part:

This subclass is indented under subclass 6.2. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUBCLASS:

9.5, 10.1+, 12.1, 17.1, 17.2, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.

13.5 To control predetermined sequence of operating movements (e.g., of one tool operating on work):

This subclass is indented under subclass 13.4. Subject matter including regulating the succession of function or movement of one or more operating assemblages.

- (1) Note. The term “operating assemblage”, is intended to include a tool, or any element or group of elements, acting together, which performs an action or produces an effect upon the work or product; or which causes a tool movement necessary to deformation of the work; or which is ancillary to a deforming instrumentality.
- (2) Note. This subclass is the locus of patents disclosing control of a sequence of operations or movements of a single operating assemblage. For example, a disclosure wherein a tool advances toward and retracts from the work, under control of switches positioned at the lim-

its of travel of the tool, would be placed herein. See subclasses below for control of different mechanisms.

SEE OR SEARCH THIS CLASS, SUBCLASS:

20.2+, for sensing a tool or tool-linked part to control a predetermined sequence of operating movements in metal deforming, generally.

13.6 Of different operating assemblages:

This subclass is indented under subclass 13.5. Subject matter including regulating the functioning of at least two disparate operating assemblages.

- (1) Note. See (1) Note under subclass 13.5 for an explanation of "operating assemblage".
- (2) Note. This subclass is the locus of patents disclosing control of a sequence of operations performed by different operating assemblages responsive to a tool. For example, a device wherein a metal-deforming tool strikes a limit switch causing a cutter to cut the product of the tool, and/or causing a handler to discharge the product from the machine, would be found in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

14.6+, for deforming by rolling wherein the operation of a plurality of operating assemblages is responsive to a device other than a deforming tool.

20.3+, for sequential control of different operational assemblages in a metal deforming machine, generally.

13.7 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 13.6. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass

are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received.

11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

13.8 Including work handling or product handling:

This subclass is indented under subclass 13.6. Subject matter including regulating an operating assemblage which moves, guides, or affects the motion of work* or product*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

20.5, for a metal deforming machine, generally, with sensing of a tool or tool-linked part of different operating assemblages including work or product handling.

14.1 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 13.4. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the

presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received.
11.2+, 13.2, 13.7, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

14.2 To control operation of interlock:

This subclass is indented under subclass 13.4. Subject matter provided with a mechanism to prevent movement of an element or a portion of a machine, and further provided with a device for disabling the movement-preventing mechanism, comprising regulating the disabling device.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

21.2, for a metal deforming machine, generally, with sensing of a tool or tool-linked part to control operation of an interlock.

SEE OR SEARCH CLASS:

83, Cutting, subclass 366 for interlock means in a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.

14.3 To stop machine:

This subclass is indented under subclass 13.4. Subject matter comprising terminating or tending to terminate the operation in response to a predetermined position of a tool.

- (1) Note. This subclass (is not intended to include, for original placement, a patent claiming an operation wherein a cam surface (on or linked to a tool) directly causes movement of a clutch element to disengage a tool from its drive. Such patent lacks the teaching of an initiating means, and will be placed on the basis of the deforming structure and found in this subclass (26) only as a cross-reference.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 1+, for a machine, or a part thereof, stops in response to a random signal or impulse.
- 21.3, for a metal deforming machine, generally, with sensing of a tool or tool-linked part to stop the operation of the machine.
- 30.2+, for a deforming by a roller wherein a machine, or a part thereof, stops when an intended operation has been completed.

14.4 Sensing force on tool:

This subclass is indented under subclass 13.4. Subject matter including detecting the pressure applied to the tool or tool-linked part.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

10.4+, and 21.4+, for other sensing of force.

14.5 By sensing hydraulic pressure:

This subclass is indented under subclass 14.4. Subject matter including detecting the pressure on the tool by use of a detector responsive to liquid head.

14.6 To control different operating assemblages:

This subclass is indented under subclass 6.2. Subject matter including regulating the functioning of at least two disparate operating assemblages.

- (1) Note. The term “operating assemblage”, is intended to include a tool, or any element or group of elements, acting together, which performs an action or produces an effect upon the work or product; or which causes a tool movement necessary to deformation of the work; or which is ancillary to a deforming instrumentality.
- (2) Note. This subclass is the locus of rolling to deform including control of a sequence of operations performed by different operating assemblages except those responsive to tool movement (for which see subclasses 13.6+).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 13.6+, for rolling to deform metal including control of a sequence of operations performed by different operating assemblages including those responsive to tool movement; and see (2) Note above.
- 21.6, for a metal deforming machine, generally, with control of different operating assemblages.

14.7 **Controlling deflector:**

This subclass is indented under subclass 6.2. Subject matter including regulating the member that deforms work by diverting a portion thereof as it passes by.

14.8 **Including use of sensor responsive to information carried by removable auxiliary record (e.g., recording disk, tape, or card):**

This subclass is indented under subclass 6.1. Subject matter including using a separate device inserted into, attached to, or applied to, the machine, and detecting physical characteristics of the device to control the operation of the machine.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.1+, for a sensor which detects a removable auxiliary record to responsively regulate a roller or roller-like metal deforming machine.

SEE OR SEARCH CLASS:

- 66, Textiles: Knitting, subclasses 215+ for knitting by use of a pattern-responsive control means which may be removable from a knitting device.
- 83, Cutting, subclasses 76.1+ for cutting with use of a control means responsive to a replaceable information program. Also, see (4) Note under the definition of Class 72, subclass 6.1.
- 139, Textiles: Weaving, subclasses 317+ for pattern-responsive control means.
- 226, Advancing Material of Indeterminate Length, subclass 9, and see (4) Note under the definition of Class 72, subclass 6.1.

14.9 **Including plural sensors or sensor responsive to comparison between plural conditions:**

This subclass is indented under subclass 14.8. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics; in either case, then comparing the characteristics and generating a resultant impulse representing the similarities or differences between the detected characteristics, whereby the regulating means governs the machine in accordance with the resultant impulse to correct incipient errors in the machine or to maintain operation of the machine.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.2+, 8.1+, and 16.1+, for other metal deforming including multiple sensing with comparison of impulses from the sensors.
- 11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing but without comparison of impulses from the sensors.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 72+ for “self-regulating” or “feedback” control means, and see (4) Note under the definition of Class 72, subclass 6.1.

15.1 **Sensing “memory” stored on tool or tool-linked part:**

This subclass is indented under subclass 14.9. Subject matter including use of structure having an impressible media capable of holding data which is part of the instrumentality for engaging the work for deforming, or is fixedly attached thereto.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 8.2+, for sensing “memory” stored on a tool or tool-linked to regulate a metal deforming machine, generally.

15.2 **Sensing “pattern”:**

This subclass is indented under subclass 14.9. Subject matter including using a contoured guide engaged by a traversing follower con-

nected to a metal deforming tool such that the tool follows a path identical to the contours of the guide as the tool engages the work for deformation thereof.

- (1) Note. The term “pattern” (in the title) refers to a model or prototype insertable into and removable from the machine and having a shape or configuration exactly similar or proportional to the shape or configuration of the desired product. A cam or eccentric or other object which is distorted with respect to the desired product is not considered to be a pattern, and control disclosures of such objects may be found in other subclasses appropriate to the deformer.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.3, for a removable pattern to be used in a condition responsive control means of a roller or roller-like metal deforming means.
- 82, for deforming of a rotating workpiece by use of a “pattern” that causes tool movement without a control means energized in response of an activator.

15.3 Sensing work or product (e.g., by X-ray):

This subclass is indented under subclass 14.9. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.

- (1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.
- (2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.4+, 8.3+, 11.1+, 16.2+, and 17.3+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system

responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.

- 226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

15.4 Sensing lead end or tail end:

This subclass is indented under subclass 15.3. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.5, 8.8, 11.5, 12.5, 16.7, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

15.5 Sensing cross sectional dimension:

This subclass is indented under subclass 15.3. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.6+, 8.9+, 11.6+, 12.7+, 16.8+, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

16.1 Including plural sensors or sensor responsive to comparison between plural conditions:

This subclass is indented under subclass 6.1. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics; in either case, then comparing the characteristics and generating a resultant impulse representing the similarities or differences between the detected characteristics, whereby the regulating means governs the machine in accordance with the resultant impulse to cor-

rect incipient errors in the machine or to maintain operation of the machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.2+, 8.1+, and 14.9+, for metal deforming including multiple sensing with comparison of impulses from the sensors.
11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing but without comparison of impulses from the sensors.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 72+ for “self-regulating” or “feedback” control means, and see (4) Note under the definition of Class 72, subclass 6.1.

16.2 Sensing work or product (e.g., by X-ray):

This subclass is indented under subclass 16.1. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.

- (1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.
- (2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.4+, 8.3+, 11.1+, 15.3+, and 17.3+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.
226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

16.3 Sensing performance of work or product:

This subclass is indented under subclass 16.2. Subject matter comprising use of detecting means responsive to the capability of the work* or product* when subjected to its intended use.

- (1) Note. Included herein is a deforming device for shaping an aircraft wing wherein air is passed over the wing to determine turbulence generated thereby, and wherein the deforming device is modified accordingly.

16.4 Work and product:

This subclass is indented under subclass 16.2. Subject matter including detecting a characteristic of the work* for the machine and detecting a characteristic of the product* of the same machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.4, and 18.2, for other sensing of both work and product.

16.5 Sensing temperature:

This subclass is indented under subclass 16.2. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.5, 11.3, 12.2, 18.3, and 19.1, for other sensing of temperature.

16.6 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 16.2. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

- (1) Note. A typical disclosure found in this subclass comprises a system including two rolling mills through which the work passes sequentially. In the space between the rolling mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line

indicates the tautness of the work passing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.6+, 11.4, 12.3, 18.4, and 19.2, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

16.7 Sensing lead end or tail end:

This subclass is indented under subclass 16.2. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.5, 8.8, 11.5, 12.5, 15.4, 18.5, and 19.4, for other sensing of the lead end or tail end of work or product.

16.8 Sensing cross sectional dimension:

This subclass is indented under subclass 16.2. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.6+, 8.9+, 11.6+, 12.7+, 15.5, 18.6+, and 19.6+, for other sensing of cross sectional dimension of work or product.

16.9 Sensing thickness:

This subclass is indented under subclass 16.8. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the extent of the lesser dimension.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.2+, 11.8+ and 18.8, for other sensing of work thickness to control a metal deforming machine.

17.1 Sensing tool or tool-linked part:

This subclass is indented under subclass 16.2. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.5, 10.1+, 12.1, 13.4+, 17.2, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.

17.2 Sensing tool or tool-linked part:

This subclass is indented under subclass 16.1. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.5, 10.1+, 12.1, 13.4+, 17.1, 18.9, and 20.1+, for other sensing of a tool or tool-linked part.

17.3 Sensing work or product (e.g., by X-ray):

This subclass is indented under subclass 6.1. Subject matter including detecting a characteristic of the work* for, or the product* of, the machine.

- (1) Note. Sensing a “Blank Holder”* or a work* holder is included herein.
- (2) Note. A deforming tool* is not considered to be a “detector”; therefore, detecting a tool* in direct engagement with the work is not considered to be detecting the “work or product” for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.4+, 8.3+, 11.1+, 15.3+, and 16.2+, for other control by sensing of work or product.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 79+, 211, 286+, 358+, and 360+ for a control system responsive to work for, or product of, a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.

226, Advancing Material of Indeterminate Length, subclasses 10+ for a control system responsive to work for feeding the work, and see (4) Note under the definition of Class 72, subclass 6.1.

18.1 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 17.3. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received.

11.2+, 13.2, 13.7, 14.1, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

18.2 Work and product:

This subclass is indented under subclass 18.1. Subject matter including detecting a characteristic of the work* for the machine and detecting a characteristic of the product* of the same machine.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.4, and 16.4, for other sensing of both work and product.

18.3 Sensing temperature:

This subclass is indented under subclass 18.1. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.5, 11.3, 12.2, 16.5, and 19.1, for other sensing of temperature.

18.4 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 18.1. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

- (1) Note. A typical disclosure found in this subclass comprises a system including two deforming mills through which the work passes sequentially. In the space between the mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line indicates the tautness of the work passing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.6+, 11.4, 12.3, 16.6, and 19.2, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

18.5 Sensing lead end or tail end:

This subclass is indented under subclass 18.1. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.5, 8.8, 11.5, 12.5, 15.4, 16.7, and 19.4, for other sensing of the lead end or tail end of work or product.

18.6 Sensing cross sectional dimension:

This subclass is indented under subclass 18.1. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.6+, 8.9+, 11.6+, 12.7+, 15.5, 16.8+, and 19.6+, for other sensing of cross sectional dimension of work or product.

18.7 Sensing flatness (e.g., crown):

This subclass is indented under subclass 18.6. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the planar characteristic of one of the greater surfaces.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.1, and 11.7, for other sensing of flatness, used to regulate the operation of a metal deforming machine.

18.8 Sensing thickness:

This subclass is indented under subclass 18.6. Subject matter wherein the work includes a greater and a lesser lateral dimension and wherein the detecting discerns the extent of the lesser dimension.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.2+, 11.8+ and 16.9, for other sensing of work thickness to control a metal deforming machine.

18.9 Sensing tool or tool-linked part:

This subclass is indented under subclass 18.1. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement therewith.

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.5, 10.1+, 12.1, 13.4+, 17.1, 17.2, and 20.1+, for other sensing of a tool or tool-linked part.

19.1 Sensing temperature:

This subclass is indented under subclass 17.3. Subject matter including detecting the degree of heat content in the work* or the product*.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

8.5, 11.3, 12.2, 16.5, and 18.3, for other sensing of temperature.

19.2 Sensing slack or tension (e.g., by use of dancer):

This subclass is indented under subclass 17.3. Subject matter including (a) detecting the lateral movement of a flexible portion of an elongated workpiece or (b) detecting the degree of tautness in an elongated workpiece.

- (1) Note. A typical disclosure found in this subclass comprises a system including two deforming mills through which the work passes sequentially. In the space between the mills, the work is engaged by a detecting means urged against the work along a line substantially at right angles to the direction of work movement. The position of said means along that line indicates the tautness of the work passing between the mills, and this position is used to control the tautness.

SEE OR SEARCH THIS CLASS, SUBCLASS:

8.6+, 11.4, 12.3, 16.6, and 18.4, for other sensing of slack or tension in work or product.

SEE OR SEARCH CLASS:

226, Advancing Material of Indeterminate Length, subclass 44 for a “dancer” controlling feed of material, and see (4) Note under the definition of Class 72, subclass 6.1.

19.3 With deforming of work by sensor:

This subclass is indented under subclass 19.2. Subject matter wherein the detector engages the work with sufficient force to stress the work beyond its elastic limit.

19.4 Sensing lead end or tail end:

This subclass is indented under subclass 17.3. Subject matter including detecting the forward edge or the trailing edge of moving work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.5, 8.8, 11.5, 12.5, 15.4, 16.7, and 18.5, for other sensing of the lead end or tail end of work or product.

19.5 Including sensor responsive to infeed or outpuller:

This subclass is indented under subclass 17.3. Subject matter wherein the detector senses the device for causing material to move into or away from the metal deforming device.

SEE OR SEARCH THIS CLASS, SUBCLASS:

12.6, for metal deforming responsive to an infeed or outpuller, for use a roller or roller-type tool.

19.6 Sensing cross sectional dimension:

This subclass is indented under subclass 17.3. Subject matter including moving the work in a given direction, and detecting the extent of the work at right angles to such direction.

- (1) Note. This subclass includes patents disclosing the measurement of work thickness by electrostatic, magnetic, or radiant energy (e.g., “X-ray”) detecting means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.6+, 8.9+, 11.6+, 12.7+, 15.5, 16.8+, and 18.6+, for other sensing of cross sectional dimension of work or product.

19.7 To control operation of deformer directly by sensor:

This subclass is indented under subclass 19.6. Subject matter including use of a detector means, an initiator, and a regulator which governs or causes the operation of the metal deforming device as the immediate result of detecting the lateral extent of the work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

12.8, for a metal deforming machine that uses a roller or roller-like tool, controlling the cross sectional dimension of the work or product directly by the sensor.

19.8 Including use of sensor responsive to energy input to tool or tool driver:

This subclass is indented under subclass 6.1. Subject matter including detecting a variation in the power required to drive a deforming tool*.

- (1) Note. Compare the subject matter of this subclass with that of subclasses 28.1+. A patent for these subclasses discloses a detecting means (e.g., a solenoid in this subclass or a pressure-responsive diaphragm in the indented subclass 20) that discerns an overload or change in load of electrical or hydraulic pressure, whereas a patent for subclasses 28+ lacks a clearly evident detecting means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

13.1+, for a metal deforming machine, which uses a roller or roller-like tool, including use of a sensor responsive to energy input to the tool or tool driver.

19.9 Sensing pressure of tool actuating fluid:

This subclass is indented under subclass 19.8. Subject matter wherein the tool is driven by a pneumatic or hydraulic system including detecting the force per unit of area in that system.

- (1) Note. Compare the subject matter of this subclass with that of subclasses 28.1+. A patent for these subclasses discloses a detecting means (e.g., a solenoid in this subclass or a pressure-responsive diaphragm in the indented subclass 20) that discerns an overload or change in load of electrical or hydraulic pressure, whereas a patent for subclasses 28.1+ lacks a clearly evident detecting means.

20.1 Sensing tool or tool-linked part:

This subclass is indented under subclass 6.1. Subject matter including detecting a condition of a tool* or of a machine element connected to the tool for movement

- (1) Note. Original placement of a patent in this or a subclass indented hereunder requires that the machine element partakes of tool movement, either directly

or proportionately, whether the element is fixed to the tool or connected thereto by a linkage.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9.5, 10.1+, 12.1, 13.4+, 17.1, 17.2, and 18.9, for other sensing of a tool or tool-linked part.

20.2 To control predetermined sequence of operating movements (e.g., of one tool operating on work):

This subclass is indented under subclass 20.1. Subject matter including regulating the succession of function or movement of one or more operating assemblages.

- (1) Note. The term “operating assemblage”, is intended to include a tool, or any element or group of elements, acting together, which performs an action or produces an effect upon the work or product; or which causes a tool movement necessary to deformation of the work; or which is ancillary to a deforming instrumentality.
- (2) Note. This subclass is the locus of patents disclosing control of a sequence of operations or movements of a single operating assemblage. For example, a disclosure wherein a tool advances toward and retracts from the work, under control of switches positioned at the limits of travel of the tool, would be placed herein. See subclasses below for control of different mechanisms.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

13.5+, for sensing a tool or tool-linked part to control a predetermined sequence of operating movements in metal deforming by use of a roller or roller-like tool.

20.3 Of different operating assemblages:

This subclass is indented under subclass 20.2. Subject matter including regulating the functioning of at least two disparate operating assemblages.

- (1) Note. See (1) Note under subclass 20.2 for an explanation of “operating assemblage”.

(2) Note. This subclass is the locus of patents disclosing control of a sequence of operations performed by different operating assemblages responsive to a tool. For example, a device wherein a metal-deforming tool strikes a limit switch causing a cutter to cut the product of the tool, and/or causing a handler to discharge the product from the machine, would be found in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

13.6+, for sequential control of different operational assemblages in a metal deforming machine that uses a roller or roller-like tool.

21.6, for deforming generally wherein the operation of a plurality of operating assemblages is responsive to a device other than a deforming tool.

20.4 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 20.3. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.
- (2) Note. The detecting means fitting part (a) of this definition differ from those of subclass 16.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means

fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUBCLASS:

7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received, and see (1) Note above.

11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

20.5 Including work handling or product handling:

This subclass is indented under subclass 20.3. Subject matter including regulating an operating assemblage which moves, guides, or affects the motion of work* or product*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

13.8, for a metal deforming machine, which uses a roller or roller-like tool, with sensing of a tool or tool-linked part of different operating assemblages including work or product handling.

21.1 Including plural sensors or sensor responsive to plural conditions:

This subclass is indented under subclass 20.1. Subject matter including using (a) multiple detecting means to discern a corresponding number of characteristics, or (b) a single detecting means to discern multiple characteristics.

- (1) Note. The detecting means fitting part (a) of this definition differ from those of subclass 8.1 in that those of this subclass are not necessarily related, nor is a comparison made between the impulses generated thereby. The detecting means fitting part (b) of this definition may, for example, detect the leading and the trailing edges of a workplace, or detect the presence of, and the temperature of, a workplace.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 7.2+, 8.1+, 14.9+, and 16.1+, for metal deforming including multiple detecting but with comparing of the impulses received.
- 11.2+, 13.2, 13.7, 14.1, 18.1+, 20.4, and 21.1, for metal deforming including multiple sensing without comparison of impulses from the sensors.

21.2 To control operation of interlock:

This subclass is indented under subclass 20.1. Subject matter provided with a mechanism to prevent movement of an element or a portion of a machine, and further provided with a device for disabling the movement-preventing mechanism, comprising regulating the disabling device.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 14.2, for a metal deforming machine having a roller or roller-like tool, with sensing of a tool or tool-linked part to control operation of an interlock.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 366 for interlock means in a cutting machine, and see (4) Note under the definition of Class 72, subclass 6.1.

21.3 To stop machine:

This subclass is indented under subclass 20.1. Subject matter comprising terminating or tending to terminate the operation in response to a predetermined position of a tool.

- (1) Note. This subclass (is not intended to include, for original placement, a patent claiming an operation wherein a cam surface (on or linked to a tool) directly causes movement of a clutch element to disengage a tool from its drive. Such patent lacks the teaching of an initiating means, and will be placed on the basis of the deforming structure and found in this subclass (26) only as a cross-reference.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 1+, for a machine, or a part thereof, stops in response to a random signal or impulse.
- 14.3, for a metal deforming machine having a roller or roller-like tool, with sensing of a tool or tool-linked part to stop the operation of the machine.
- 30.1, for a deforming generally wherein a machine, or a part thereof, stops when an intended operation has been completed.

21.4 Sensing force on tool:

This subclass is indented under subclass 20.1. Subject matter including detecting the pressure applied to the tool or tool-linked part.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 10.4+, and 14.4+, for other sensing of force.

21.5 By sensing hydraulic pressure:

This subclass is indented under subclass 21.4. Subject matter including detecting the pressure on the tool by a detector responsive to liquid head.

21.6 To control different operating assemblages:

This subclass is indented under subclass 6.1. Subject matter provided with a plurality of diverse operating assemblages wherein the regulating means governs the functioning of the various operating assemblages.

- (1) Note. The term “operating assemblage”, is intended to include a tool, or any element or group of elements, acting together, which performs an action or produces an effect upon the work or product; or which causes a tool movement necessary to deformation of the work; or which is ancillary to a deforming instrumentality.
- (2) Note. This subclass is the locus of deforming including control of a sequence of operations performed by different operating assemblages except those responsive to tool movement (for which see subclass 20.3).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 14.6, for a metal deforming machine having a roller or roller-like tool, with control of different operating assemblages.
- 20.3, for metal deforming including control of a sequence of operations performed by different operating assemblages including those responsive to tool movement; and see (2) Note above.

28.1 WITH USE OF SELF REGULATING CONTROL SYSTEM UTILIZING ELECTRICAL OR HYDRAULIC ENERGY:

This subclass is indented under the class definition. Subject matter comprising apparatus including, or method employing, at least two devices that deform work, each device being driven or governed by a motor powered either by fluid under pressure or by electricity, but in either case from a source of power common to all the motors, wherein the operation of one such motor is regulated or modified by a change (including an incipient change) in the power demand or operating condition of another such motor, thereby changing (or tending to change) the ratio of power supplied to each motor.

- (1) Note. Compare the subject matter of this and the indented subclasses (28.1+) with that of subclasses 13.1+ and 19.8+. In a device of this subclass, back pressure (in a hydraulic motor) or back electromotive force (in an electrical motor) as the agency to govern the operation of another such motor, whereas a device or subclasses 13.1+ and 19.8+, clearly teaches use of a detecting means to sense a condition.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 13.1+, and 19.8+, and see (1) Note above.

28.2 Metal deforming by use of roller or roller-like tool element:

This subclass is indented under subclass 28.1. Subject matter comprising apparatus including, or method employing, a roller* tool or a roller-like tool* to deform work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 6.2+, and 30.2, for other deforming by a roller or roller-like tool including control of the tool.
- 67+, for deforming by relative rotation between a workpiece and a tool, particularly subclass 75 for a spherical tool, subclasses 91+ for deforming by a roller or roller-like tool cooperating with an opposing concave surface, subclasses 110+ for a roller cluster, and subclass 124 for a roller cooperating with a work-spaced tool.
- 127+, for deflecting to deform metal which may include use of a roller or roller-like tool, particularly subclasses 162+ for "levelling" by use of relatively-inclined successive rollers, subclasses 178+ for "troughing" by use of a roller cluster, subclasses 179+ and 182 for use of a roller couple.
- 184+, for deforming by a "flying tool" that may comprise a roller or roller-like tool.
- 199+, for deforming by a roller or roller-like tool, generally.
- 366.2, for a method of deforming by a disclosed (but not claimed) rollers.

SEE OR SEARCH CLASS:

- 228, Metal Fusion Bonding, subclass 158 for rolling of metal parts combined with independent fusion bonding of the parts; and subclass 243 for simultaneous rolling and fusion bonding of the parts.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 363+ for a press forming or press reshaping means for nonmetal including an endless (e.g., roll, etc.) forming surface.

29.1 Utilizing electrical energy:

This subclass is indented under subclass 28.2. Subject matter wherein the motive power for a driving motor thereof is electricity.

29.2 Utilizing electrical energy:

This subclass is indented under subclass 28.1. Subject matter wherein the motive power for a driving motor thereof is electricity.

30.1 WITH STOPPING UPON COMPLETION OF PRESCRIBED OPERATION:

This subclass is indented under the class definition. Subject matter comprising apparatus including, or method employing, one or more parts of a machine that are brought to a halt after the machine or the part has finished its intended action.

- (1) Note. This subclass is not intended as the repository for all devices that include cessation of machine operation. Only a patent including a claim which clearly indicates machine stoppage after the completion of an intended operation is included herein as an “original”.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 1+, for a machine, or a part thereof, which stops in response to a random signal or impulse.
- 14.3, 21.3, for a machine, or a part thereof, which stops in response to a tool sensor.

30.2 Metal deforming by use of roller or roller-like tool element:

This subclass is indented under subclass 30.1. Subject matter comprising apparatus including, or method employing, a roller* tool or a roller-like tool* to deform work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 6.2+, and 28.2+, for other deforming by a roller or roller-like tool including control of the tool.
- 67+, for deforming by relative rotation between a workpiece and a tool, particularly subclass 75 for a spherical tool, subclasses 91+ for deforming by a roller or roller-like tool cooperating with an opposing concave surface, subclasses 110+ for a roller cluster, and subclass 124 for a roller cooperating with a work-spaced tool.
- 127+, for deflecting to deform metal which may include use of a roller or roller-like tool, particularly subclasses 162+ for “levelling” by use of relatively-inclined successive rollers, subclasses 178+ for “troughing” by use of

a roller cluster, subclasses 179+ and 182 for use of a roller couple.

- 184+, for deforming by a “flying tool” that may comprise a roller or roller-like tool.
- 199+, for deforming by a roller or roller-like tool, generally.
- 366.2, for a method of deforming by a disclosed (but not claimed) rollers.

SEE OR SEARCH CLASS:

- 228, Metal Fusion Bonding, subclass 158 for rolling of metal parts combined with independent fusion bonding of the parts; and subclass 243 for simultaneous rolling and fusion bonding of the parts.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 363+ for a press forming or press reshaping means for nonmetal including an endless (e.g., roll, etc.) forming surface.

31.01 WITH INDICATION OF CONDITION OR POSITION OF WORK, PRODUCT, OR MACHINE ELEMENT (E.G., BROKEN TOOL ALARM, ETC.):

This subclass is indented under the class definition. Subject matter comprising a step of, or means for visibly, audibly, or tacitly signaling information related to a physical state or location of the work, a product, or component of a manufacturing means of this class.

- (1) Note. This subclass (31.01) is the locus of patents directed to means for or method of signaling the occurrence of a give condition (e.g., absent or misaligned work, etc.) associated with a device or operation of the class type. The signal is generally of the off or on type; if measurement or counting is involved, the combination should be placed in the subclasses indented hereunder.
- (2) Note. The provision of a gauge, mark, or scale on a machine table, against which the work is to be laid for direct measurement, comparison, or placement for an operation of the class type, is not deemed an “indicator” for this subclass; similarly, the step of visual inspection (for length, straightness, etc.) is not deemed

detection or indication for this subclass.
A patent claiming any of the above-noted features would be placed on the basis of its other claimed subject matter.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 1+, for an indicator associated with randomly actuated stopping means in metal-deforming apparatus.
- 6+, for an indicator associated with automatic control means in metal-deforming apparatus.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 407 for the step of testing or indicating in a process of mechanical manufacture.
- 73, Measuring and Testing, appropriate subclasses for quantitative indicator, meter, or gauge associated with measuring or testing apparatus.
- 83, Cutting, subclasses 522.11+ for a signal, scale, or indicator associated with cutting apparatus.
- 116, Signals and Indicators, for such a device, per se.
- 168, Farriery, subclasses 45+ for hand tools related to the installation and maintenance of horse shoes.
- 235, Registers, subclass 128 for alarm mechanism applicable to devices such as metal-deforming apparatus.
- 340, Communications: Electrical, subclasses 500+ for an indicator in an electrical signaling system applicable to metal-deforming apparatus.

31.02 Trueness (e.g., devices for repairing, etc.):

This subclass is indented under subclass 31.01. Subject matter wherein the information relates to a deviation of deformation of the work from its intended deformation by an operation of this class.

31.03 Elongate member straightening:

This subclass is indented under subclass 31.02. Subject matter wherein the work comprises a member having two ends separated by a distance substantially longer than the girth thereof and the intended deflection between said two ends is zero.

31.04 Tube or rod bending:

This subclass is indented under subclass 31.01. Subject matter wherein the work comprises a hollow or solid elongate cylinder having a longitudinal axis and the information relates to the deflection of said cylinder perpendicular to said axis.

31.05 Deflection angle:

This subclass is indented under subclass 31.04. Subject matter wherein the information relates to the degree of deflection of said cylinder.

- (1) Note. Conduit benders and offsetters are collected herein.

31.06 Tube diameter resizing:

This subclass is indented under subclass 31.01. Subject matter wherein the work comprises a hollow elongate cylinder having a cross section perpendicular to the length thereof and the information relates to a change in girth of the cross section without substantially altering the shape thereof.

31.07 Including deformation by roller or roller-like tool:

This subclass is indented under subclass 31.01. Subject matter including a tool having a generally circular cross section which defines a peripheral edge which acts upon the work while simultaneously rotating about an axis passing through the cross section.

31.08 Distance between tools of tool couple:

This subclass is indented under subclass 31.07. Subject matter including a pair of peripheral edge acting tools which simultaneously act in opposite directions upon the work and wherein the information relates to the relative degree of separation between the tools.

31.09 Work guide position:

This subclass is indented under subclass 31.07. Subject matter including means for orienting or locating the work moveable in relation thereto with respect to the tool and wherein the information relates to the location or orientation of the work with respect to the tool.

31.1 Including deformation by simple bending:

This subclass is indented under subclass 31.01. Subject matter including means for creasing or folding the work about an axis without substantially altering dimensions of the work in a direction normal to the axis of the crease or fold.

- (1) Note. Simple bending may include the application of plural creases about plural distinct axes.

SEE OR SEARCH THIS CLASS, SUBCLASS:

31.01, for a metal deforming means with a indicator wherein the work is twisted about an axis.

31.11 Tool or tool driver travel:

This subclass is indented under subclass 31.10. Subject matter wherein the means for creasing or folding the work is moveable in a direction normal to the surface of the work simultaneous with the creasing or folding operation and wherein the information relates to the distance the creasing or folding means is moveable.

31.12 Work stop position:

This subclass is indented under subclass 31.10. Subject matter including means for abutting an edge of the work to locate the work with respect to the creasing or folding means and wherein the information relates to the location or orientation of the abutting means with respect to the tool.

- (1) Note. The abutting means of this subclass positively engages the work for fixing the position at which the tool will act thereon.

31.13 Work drawn or extruded through die:

This subclass is indented under subclass 31.01. Subject matter wherein the work is pulled or pushed through a closed die*.

37 WITH USE OF OPTICAL OR TRANSPARENT (E.G., VIEWING) MEANS:

This subclass is indented under the class definition. Subject matter comprising the step of, or means for, utilizing the production, transmission, reflection, or refraction of visible light

rays in combination with a step of, or means for, deforming metal.

- (1) Note. A mere opening or recess in a machine housing to permit visual inspection of work or tool condition is not deemed “optical means” within the scope of the subclass definition; a transparent window material, or a lamp, mirror, lens, etc., is regarded as “optical means” for the purposes of this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

31.01+, for the use of optical means in signals, gauges, indicators, etc., in metal-deforming devices.

SEE OR SEARCH CLASS:

83, Cutting, subclass 520 for illuminating or viewing means for work in cutting apparatus.

38 WITH EXPOSURE OF WORK TO GAS, VAPOR, MIST, OR MODIFIED ATMOSPHERE:

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, the subjecting of work to the action of a gas or gaseous suspension of material, including air under other than ordinary ambient or atmospheric conditions, or the removal or exclusion of air from contact with work, prior to or during an operation of the class type.

- (1) Note. This subclass is the locus of patents directed to (a) passive means, such as air locks, seals, etc., for preventing contact of work with air before or during a metal-deforming operation, or (b) active means such as suction pump, etc., for evacuating a work-containing chamber, or (c) nozzles, ducts, etc., for supplying any gaseous element, mixture, or suspension (including hot, cold, or compressed air).

SEE OR SEARCH THIS CLASS, SUBCLASS:

39, for applying water or any liquid to work material for cleaning or lubricating.

- 40, for sand-blasting to clean or descale work material in combination with metal deformation.
- 46, for applying water or any liquid to work, for coating or unspecified purpose.
- 69, 128, 200, 271, 286, 342, and 364, for a disclosure of temperature maintenance or modification which may involve gas or vapor contact.

39 WITH CLEANING, DESCALING, OR LUBRICATION OF WORK OR PRODUCT:

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, performing one or more of the following operations upon the material which is the subject of metal deformation (i.e., the work material), before, during, or after the deforming operation: (a) separation or removal from the surface of work material of any or all substances which may be present thereon as a spot or film of undesired material generally distinguishable from the work material per se, or (b) application of a substance to work material or to an element of a metal-deforming device, which substance is claimed or disclosed as an agent for reducing friction between forcibly engaged surfaces of work material and said device.

- (1) Note. Subject matter involving the application of gas, vapor, mist, or modified atmosphere to work, prior to or during deformation, is placed in preceding subclass 38, regardless of specific effects thereof such as cleaning, lubrication, descaling, etc.
- (2) Note. The grinding or machining of scale or oxide from work material is regarded as cleaning or descaling for this subclass, if there is no claimed redimensioning of the work material by the removal of metal.
- (3) Note. The term "lubrication" is limited for the purposes of this subclass to the application of a lubricating substance; other arrangements which may be claimed for reducing friction or tool wear (e.g., by joggings, ultrasonic vibration, etc.) are treated as perfecting fea-

tures of the specific type of deforming process or apparatus concerned.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 38, for exposure of work to gas, vapor, mist, or modified atmosphere for various purposes including cleaning or lubrication, and see (1) Note above.
- 46+, for "coating" of work (i.e., before or during deformation) which may involve disclosure of cleaning, pickling, etc.

SEE OR SEARCH CLASS:

- 118, Coating Apparatus, subclasses 72+ for apparatus for cleaning and coating of metal.
- 134, Cleaning and Liquid Contact With Solids, for a process of cleaning metal, including pickling.
- 216, Etching a Substrate: Processes, subclass 6 for the formation of a capacitor using etching in the process.
- 427, Coating Processes, subclass 299 for processes of pretreating a base, followed by coating.

40

Mechanical cleaning:

This subclass is indented under subclass 39. Subject matter comprising a step of, or means for, effecting engagement of work material with solid substance with sufficient force to remove or facilitate removal of scale, dirt, or other undesired substance from the surface of the work material.

- (1) Note. The solid substance may be a specific cleaning tool, such as a scraper or brush, or it may be an abrasive medium as in sandblasting, or contact with other work as in tumbling, or a metal deforming tool (and see (2) Note below).
- (2) Note. The claimed removal of scale by deflection or deformation of work material, as in stretching, hammering, or edge rolling, is subject matter for this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 53, for shot-blasting of metal work to deform same.

253.1+, for dross removal associated with method or apparatus for extrusion.

SEE OR SEARCH CLASS:

- 15, Brushing, Scrubbing, and General Cleaning, for brushing, scrubbing, and general cleaning apparatus.
- 29, Metal Working, subclasses 81.01+, for a scale remover or preventer.
- 451, Abrading, for cleaning by use of an abradant.

41 Lubricating:

This subclass is indented under subclass 39. Subject matter comprising a step of, or means for, the application to work material of a substance which is claimed or disclosed as an agent for reducing friction or tool wear (i.e., a lubricant).

- (1) Note. For placement in this subclass, a patent must be directed to lubrication of work material; this may be accomplished by applying lubricant to a tool before or during its engagement with work. Lubrication of machine parts generally is excluded from this subclass.
- (2) Note. In the absence of more definitive terms, the reference to "oil", or to the reduction of friction or wear, is regarded as defining a lubricant for this subclass. The application of water or an aqueous solution, with no reference to lubrication, is proper subject matter for subclass 39 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 38, for exposure of work to gas, vapor, mist, or modified atmosphere.
- 46+, for coating of work (possible value as a lubricant).
- 69, for lubrication of tool or machine in rotating- or gyrating-tool machine.
- 236, for lubrication of a roller or roller-like tool-element or the associated machine.
- 463, for a tool having passageway usable for lubrication.

SEE OR SEARCH CLASS:

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 90+ for apparatus to shape or reshape non-metals combined with a means to apply a coating (e.g., painting, etc.) material to the work or work contact means.

42 With particular lubricant:

This subclass is indented under subclass 41. Subject matter wherein the lubricating substance is particularly specified, as by chemical formulation or by recitation of a name which identifies a single chemical organization, such as "water" or "caustic potash".

- (1) Note. Generic terms such as "oil, glass, metal, fluid", etc., are not included here, but a descriptive species thereof is (e.g., "palm oil"). The term "soap" is arbitrarily considered to be specific, and when used as lubricant is classified here.

SEE OR SEARCH CLASS:

- 508, Solid Anti-Friction Devices, Materials Therefor, Lubricant or Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, for a lubricating composition, per se.

43 With means to apply lubricant:

This subclass is indented under subclass 41. Apparatus including structural means for causing or allowing the lubricant to contact the work or tool.

SEE OR SEARCH CLASS:

- 184, Lubrication, for lubricating apparatus in general.

44 With means to transfer lubricant:

This subclass is indented under subclass 43. Device comprising structure effective to cause movement or flow of the lubricating medium (e.g., wick, roller).

45 Force feed:

This subclass is indented under subclass 44. Device comprising means to develop pressure in the lubricant prior to its contact with the work or tool.

- (1) Note. This subclass contains all systems for lubricating work material where a force, other than that acting on the work or tool, is required to transfer the lubricant.
- (2) Note. The term “force” for the purposes of this subclass excludes the force of gravity.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 44, for structure utilizing gravity feed of lubricant in a metal-deforming device.

46 WITH “COATING” OF WORK:

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, the application of plastic or liquid material to work as a coherent film, cover, or spot, prior to or during an operation of the class type, which material or residue thereof is disclosed as remaining on the surface of the work, at least until said operation has been completed.

- (1) Note. This subclass is the locus of patents directed to metal deformation preceded by the application of molten, plastic, or liquid substance to all or a portion of the surface of work, provided that the substance or a residual part thereof remains on the work as a distinguishable layer, at least throughout the deforming operation, or as a more or less durable coating. Water may thus constitute a “coating” for this subclass.
- (2) Note. The coating may be applied by brushing, spraying, casting, molding, etc., or by any technique other than attachment of a preform (a self-sporting shape), which latter constitutes “assembly” for Class 29, Metal Working.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 39+, for cleaning or descaling in connection with metal deforming.
- 41+, for application of material claimed or disclosed as a lubricant.
- 271, 286, 342, and 364, for a disclosure of temperature maintenance or modifica-

tion of work material which may involve application of fluent material as a heating or cooling agent.

SEE OR SEARCH CLASS:

- 29, Metal Working, appropriate subclasses for process or apparatus for assembly of objects (preforms) not elsewhere classified, particularly subclasses 527.1+ for (a) process of casting and deforming a metal workpiece, (b) a process involving deforming and coating plus additional treatments excluded from this class, and (c) process involving casting or coating subsequent to deformation.
- 118, Coating Apparatus, subclass 75 for combined coating and noncoating apparatus, generally.
- 219, Electric Heating, for electric arc deposition of one metal on another followed by metal deformation.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 90+ for apparatus to shape or reshape nonmetals combined with means to apply a coating to the work or work-contacting surfaces.

47

Metal coating:

This subclass is indented under subclass 46. Patents in which the applied coating is metal*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 264+, for extruding a metallic sheath on a cable or other core.

SEE OR SEARCH CLASS:

- 204, Chemistry: Electrical and Wave Energy, subclasses 192.12+ for glow discharge sputter deposition (e.g., cathode sputtering to deposit a metal coating, etc.), subclasses 194+ for electrolytic apparatus (e.g., used for electroplating, etc.), and subclasses 298.02+ for sputter coating apparatus (e.g., used to deposit a metal coating, etc.).
- 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclasses 80+ for electrolytic coating (e.g., electroplating, etc.).

48 BY TOOL COUPLE PRESSING TOGETHER ADJACENT SURFACE PORTIONS OF SAME WORK (E.G., TUBE SEAMER):

This subclass is indented under the class definition. Subject matter including a tool couple* for, or a step of using a tool couple for, joining (i.e., securing one to another) two or more juxtaposed margins, parts of the face, or edges of a single piece of work.

- (1) Note. A claimed tool couple will be identified with particularity sufficient to meet the requirements of this subclass if a claim recites any of the following: (a) the nature of the workpiece or the product (e.g., two margins or portions of a workpiece are locked or pressed together, or the product formed is a tube or pipe), the characteristics of which product indicate that a tool couple formed the product; or (b) the function of a machine (e.g., seaming rollers, operating as a tool couple, to unite a tube seam by pressure); or (c) the structure of the parts of a tool couple whose sole disclosed use is the uniting of two margins of a single workpiece.
- (2) Note. This subclass does not accept patents claiming apparatus for assembling or for welding; see section VI, A of this class for the locus of patents claiming such operations.

SEE OR SEARCH CLASS:

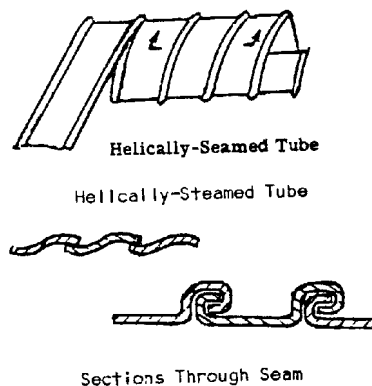
228, Metal Fusion Bonding, subclasses 15.1+ for tube-seaming apparatus involving welding; and subclasses 144+ for a process of forming a tube from a one-piece blank and welding the seam.

49 To form helically seamed tube:

This subclass is indented under subclass 48. Subject matter wherein a tool couple joins together the margins of a piece of work that has been deformed into a helical coil having adjacent side margins, whereby the product formed is a conduit or pipe having a helical joint.

- (1) Note. Usually the helical coil is deflected by structure which, per se, is found in

subclasses 135+ (which see) and an additional deformation is imposed on the work (either before, during, or after coiling) to change the cross-sectional shape thereof so that the adjacent margins will associate intimately to form a helical seam. The illustrations below (in the Figure accompanying this note) exemplify only a few of the various forms of seam disclosed in the art.



50 Using roller conforming to seam contour:

This subclass is indented under subclass 49. Subject matter wherein the tool couple includes one or more rollers* to form the joint, and wherein a cross section of the joint at the zone of formation complements (i.e., fits into) the cross-section of the roller(s) at that zone.

51 To form longitudinally seamed tube:

This subclass is indented under subclass 48. Subject matter wherein a tool couple joins together the margins of a piece of work that has been made by deforming metal having thickness, width, and length dimensions, the length being appreciably greater than the thickness of the width, so that side margins parallel to the length contact one another, whereby the product formed is a conduit or pipe having a joint parallel to the length.

52 During longitudinal movement of work:

This subclass is indented under subclass 51. Subject matter wherein the work is moved along its length dimensions as the joint is deformed.

- (1) Note. Usually the work is a web and is deformed by structure which, per se, is found in subclasses 176+ and an additional deformation is imposed on the adjacent margins, after the troughing or skelping of the work, to form the seam.

53**BY SHOTBLASTING:**

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, the forcible propulsion of discrete particles against a surface portion of work with random timing and trajectories.

- (1) Note. The particles may be propelled by any means, including air or water jets.
- (2) Note. The operation is usually termed “shotblasting” or more properly “shot peening”, but is sometimes named for the desired effect in a particular case, e.g., hardening, sizing, upsetting, enlarging, etc. Any such teaching of metal deformation, whether or not accompanied by abrasion, is proper subject matter for this subclass. Process or apparatus for burnishing a work surface, by shotblasting or other means, is classifiable in Class 29 as indicated below.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 40, for metal deformation combined with mechanical cleaning, descaling, or scouring, which may involve the application of sand or shot.
- 54+, for metal deformation by pressure transmitted through a coherent mass of fluent material (e.g., sand or shot), as distinguished from shotblasting.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 90.01+ for burnishing a surface by shotblasting and see (2) Note, above.
- 451, Abrading, subclasses 38+ for a process of sandblasting and subclasses 75+ for a machine for sandblasting.

54**BY APPLICATION OF FLUENT MEDIUM OR ENERGY FIELD:**

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, effecting mechanical treatment of metal work by (a) the conduction of pressurized fluent material in gaseous, liquid, plastic, or random particulate form into engagement with a portion of the surface or work and/or the development of pressure in fluent material while it is engaged with work, or (b) the direction of electric, magnetic, or radiant energy toward work in such manner as to induce mechanical accelerating force therein.

- (1) Note. Fluid or “fluent material” within the scope of the subclass definition comprises compressed air or gas, any liquid, any readily deformable plastic substance (which may be a soft metal), any granular or particulate material which is handled as a fluid during the deforming operation (i.e., is confined and subjected to pressure without regard to the position or motion of any specific particle thereof). A configured tool, on the other hand, such as a roller faced with soft rubber, is regarded as a flexible tool for subclass 465.1+. (Operations with such a tool may be found in subclasses 166+).
- (2) Note. The fluent material may be confined in or by a diaphragm or bag of deformable material, or within a hollow workpiece.
- (3) Note. The subclass definition, part (b) is intended to embrace the process of, or apparatus for, deforming metal by the application of heat thereto while the workpiece is held under suitable restraint. (Melting or specific heat treatment, is excluded from this class, (72).)

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 56, for deformation of metal by shock wave or pulsations of fluid, or by energy field.
- 57+, for deformation of metal by an actuated tool, the operation being modified, supplemented, or assisted by

pressurized fluid (e.g., as a plastic core within hollow work).

465.1+, for a flexible or yieldable tool, per se.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 421.1+ for a process of shaping by direct application of fluid pressure (e.g., expanding a liner in a pipe).
- 428, Stock Material or Miscellaneous Articles, subclass 586 for workpieces deformable by the application of a fluent medium, e.g., which embody stop-weld material.

55 With cutting:

This subclass is indented under subclass 54. Subject matter including a step of, or means for, cutting* the material which is the subject of deformation.

- (1) Note. See Relationship to Combination Classes in the Class Definition for a discussion of included and excluded deforming and cutting combinations.

SEE OR SEARCH THIS CLASS, SUBCLASS:

324+, for cutting or cutter associated with metal-deforming method or apparatus not specifically provided for in preceding subclasses.

SEE OR SEARCH CLASS:

83, Cutting, subclass 177, for cutting (punching, etc.) by fluid blast or suction.

56 By kinetic energy or fluid or field:

This subclass is indented under subclass 54. Subject matter utilizing (a) a pressure surge or repeated pulsations of pressure in the fluent material to develop a localized, transient, or traveling force sufficient to deform work, or (b) an electric, magnetic, or radiant energy field effective to accelerate work sufficiently to accomplish deformation thereof.

- (1) Note. For placement in this subclass, the combination must include means for, or method of, generating and/or releasing the energy required to produce deformation.

- (2) Note. This subclass is the locus for placement of patents directed to the use of explosives or pulsating devices to energize work-contacting fluid, or the use of a transient, high-intensity electromagnetic field for inducing accelerating currents in work; or to the application of heat for buckling or bending suitably restrained work, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

430, for explosive means to drive a tool.

453.01+, for fluid pressure means to drive a tool.

57 With actuated tool-engaging work:

This subclass is indented under subclass 54. Subject matter wherein a rigid instrumentality is moved against the work with deforming force.

- (1) Note. For placement in this subclass, a patent must relate to the deformation of metal by means of a driven rigid tool or work-mover, which operation is modified by, supplemented by, or is in addition to, metal deformation by direct engagement of work with fluent material.

- (2) Note. Examples of combinations for this or indented subclasses are:

(a) An actuated die forces work against a thick, soft, rubber cushion.

(b) A bending press deforms pipe which has been filled or packed with sand or plastic material to prevent collapse of the pipe wall.

(c) A multi-tool-station machine has fluent tool means at one station.

(d) Plural method steps comprise at least one deformation of work by actuated tool and one by fluent material.

(e) A punch-and-die set includes one tool face having a rubber insert engageable with the work and yieldable with respect to adjacent tool face portions.

58 Expanding hollow work:

This subclass is indented under subclass 57. Subject matter comprising a step of, or means for, the forcible engagement of pressurized fluent material with the interior surface of work, at least a portion of which has a closed periphery cross-section so that upon deformation of the work the interior area of said cross-section is enlarged.

- (1) Note. In many instances, the actuated tool engages an end of a tubular work-piece to upset to work while simultaneously trapping and imparting pressure to fluid within the work. See Fig. B in appended diagram.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 54, for constricting or collapsing hollow work by fluid pressure on the exterior thereof.

59 Corrugating tubular work:

This subclass is indented under subclass 58. Subject matter comprising a step of, or means for, the formation of two or more axially spaced, substantially identical, annular enlargements in cylindrical work.

- (1) Note. For placement in this subclass, a patent should be directed to the combination of actuated tool means and internal fluid pressure means so disposed as to produce a series of substantially similar annular ridges and grooves in tubular work; at least two spaced enlargements of similar form and size distinguishes "corrugating" from the more general inflating or expanding operations of the preceding subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 61+, for expanding hollow work against an external die by fluid pressure within the work.

60 Using fixed die:

This subclass is indented under subclass 54. Subject matter comprising a step of, or means for, limiting or restraining the movement of

work subjected to deforming force by passive or stationary work-shape-imposing structure.

- (1) Note. Compare Die* in the Glossary; for this subclass the die should be undriven and should have a definite shaping or reshaping effect on the engaged work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 57+, for an actuated tool or die in combination with fluid pressure acting on work.

61 Expanding hollow work:

This subclass is indented under subclass 60. Subject matter wherein pressurized fluent material engages the interior surface of work at least a portion of which has a closed periphery cross-section.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 58+, for expanding hollow work by a combination of fluent pressure and actuated rigid tool(s).

62 In circular section die:

This subclass is indented under subclass 61. Subject matter wherein the passive or stationary work-shape-imposing structure has an interior wall surface which corresponds throughout its extent to a surface of revolution.

- (1) Note. A die for this subclass may be skeletonized or made up of spaced segments, but its interior wall surface, wherever present, should conform to the subclass definition. See Fig. A in diagram appended to subclass 58.
- (2) Note. Some examples of tube corrugating are found here.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 58, for an actuated tool or die in combination with fluid pressure internally of the work.

63 Utilizing diaphragm between fluid and work:

This subclass is indented under subclass 60. Subject matter comprising a step of, or means for, utilizing a membrane or wall of solid, yieldable material, one surface thereof being intended to engage work and to transmit thereto force which is developed by fluent material under pressure engaging the opposite surface thereof during an operation of the class type.

- (1) Note. The usual purpose of such a diaphragm is to retain the fluent material in the device for reuse, and/or to facilitate rapid repetition of operations.
- (2) Note. For placement in this subclass, the flexible wall or sealing layer should be distinguishable from the pressurized fluent material.

SEE OR SEARCH CLASS:

- 100, Presses, subclass 211 for a press, not elsewhere classified, having a yieldable or bendable jaw surface.

64 By twisting axially moving work:

This subclass is indented under the class definition. Subject matter comprising steps of, or means for, (a) advancing work* in its entirety in a longitudinal direction so as to pass longitudinally consecutive cross sections of work (the cross sections being taken at right angles to the longitudinal direction) through a metal-deforming zone, and (b) turning each consecutive cross section in its entirety, with respect to other cross sections, about a line parallel to, or coincident with, the longitudinal direction, whereby the angular orientation of successive cross sections are modified with respect to each other.

- (1) Note. Although the title of this subclass refers to moving work, this and the indented subclasses will accept cross-reference patents disclosing a tool moving along a stationary workpiece and having the work-twisting action described above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 299, for a disclosure wherein a workpiece is clamped at two zones spaced along the work by clamps which are then rotated to twist the work lying between the clamps.

65 With adjustment of machine or variation in effect of tool on product:

This subclass is indented under subclass 64. Subject matter wherein the turning is accomplished by a metal deforming instrumentality or a tool therein, or the degree of twist in the product* can be changed or modified.

66 COILING BY WORK GUIDE MEMBER ORBITING ABOUT LONGITUDINAL CENTERLINE OR FORMED COIL:

This subclass is indented under the class definition. Subject matter comprising a step of, or means for, wrapping work* about an axis-of-bend* through more than 360° of wrap by an element that engages the work with sliding contact and revolves about, and is radially spaced from said axis-of-bend.

- (1) Note. Any point of the work traces an involute curve as the work is wrapped about the axis-of-bend. The operation usually includes movement of the wrapped work relatively along the axis-of-bend simultaneously with the wrapping thereof. By this relative movement, the product formed is a helical-coil rather than a spiral-coil. The pitch of the formed helical-coil depends on the speed of the relative axial movement during the period of time needed for one convolution of 360° of wrap. (See the definition of coil* in the Glossary of this class for discussion and illustrations of the terms used).

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 728 for apparatus similar to that of this subclass for making of armored cable; and subclass 435, for a process similar to that described herein, but assembling two (or more) workpieces.

67 BY USE OF TOOL ACTING DURING RELATIVE ROTATION BETWEEN TOOL AND WORK ABOUT INTERNAL CENTER (E.G., GYRATING OR ROTATING TOOL):

This subclass is indented under the class definition. Subject matter comprising a tool, or a step of using a tool, that turns with respect to work, or with respect to which tool the work turns, about an axis (or effective axis) that extends through the work, which tool engages the work for deformation while the turning occurs.

- (1) Note. For the purposes of this and indented subclasses, the following movements are defined:

(a)“Gyration” is turning of each point on the surface of a body about an axis specific to each point while the body as a whole remains oriented in the same compass direction. Since all the axes are parallel to each other, they form effectively the equivalent of one axis to fit the definition of the subclass. The movement can be illustrated by the movement of a pencil during the formation of the letter “O”. Many of the patents in this subclass (67) disclose the use of a gyrating tool.

(b)“Rotation” is turning of each point on the surface of a body about a single axis common to all such points. In general usage, rotation is the term often used to describe movement of the moon around the earth or of the earth around the sun, as well as movement of the earth about its own axis; however, in the subclasses indented below, the term “orbit” (and its variants) has been used to describe the former two types of movement, and the term “rotation” has been used to describe turning of a body about its own axis.

(c)“Oscillation” is swinging to-and-fro of each point on the surface of a body about a single axis common to all such points. Disclosure of such movement, occurring during deformation of work, is particularly provided for in subclasses 73 and 74.

- (2) Note. The term “turns” is intended to include only that movement wherein all the work turns, or wherein the tool-face turns relatively to all of the work. Disclosures wherein a portion of the work turns and another portion does not turn will be found in other subclasses of this schedule. An exemplary locus of such disclosures is subclasses 64+.

- (3) Note. The phrase “relative rotation” is intended to include a clear disclosure of turning about an axis wherein the axis passes through, or extends within, the confines of work as the work exists before deformation. It is not intended that this group of subclasses be the locus of disclosures wherein a product* rotates about a centerline unless the product centerline is also the work centerline. Thus, a device which deforms metal about a centerline or axis-of-bend*, wherein either the tool rotates about the centerline of the product (not the work centerline), or the product rotates about its centerline (not the work centerline), will be found in other subclasses of Class 72. Exemplary loci of such disclosures include subclasses 135+, 146+, and 212+.

68 With metal deformation of different type:

This subclass is indented under subclass 67. Subject matter including use of at least two separate instrumentalities to deform work, and wherein one such instrumentality deforms the work in a manner other than that peculiar to subclasses 67+.

69 With modification or control of temperature of work, tool, or machine, or with lubrication thereof:

This subclass is indented under subclass 67. Subject matter wherein a friction-reducing medium is applied to the tool or another portion of the deforming structure, or wherein thermal characteristics of the work, the tool, or any part of the deforming structure in which the tool functions are changed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 38, for exposure of work to gas, vapor, mist, or modified atmosphere while the work is being deformed.
- 39+, for cleaning, descaling, or lubrication of work for, or product of, a deforming operation.
- 46+, for coating of work prior to deformation thereof.

70 With cutting of work or product:

This subclass is indented under subclass 67. Subject matter wherein the tool is combined with a cutter.

- (1) Note. Patents disclosing cutting placed originally in this subclass are limited to that cutting acceptable into this class (72) in accordance with Relationship to Combination Classes, With Cutting, of the Class Definition of this class.

71 By composite cutting, deforming tool:

This subclass is indented under subclass 70. Subject matter wherein a deforming tool and a cutter are rigidly connected together such that movement of the tool is always accompanied by movement of the cutter and the operation of the cutter and of the tool result from the same movement.

- (1) Note. See search notes under subclass 464 for listing of other subclasses providing for composite-deforming cutting tools.

72 With actuation of cutter in timed relation to movement of deformer or work:

This subclass is indented under subclass 70. Subject matter wherein the cutter operates in synchronism with the tool or with the rotating work.

73 With oscillation of work about work axis:

This subclass is indented under subclass 67. Subject matter wherein the work moves to-and-fro about an axis within the confines thereof during deformation of the work.

- (1) Note. For a discussion of basic types of movement for the purposes of this group

of subclasses, see (1) Note under the definition of subclass 67.

74 With oscillation of work-engaging tool surface about work surface:

This subclass is indented under subclass 67. Subject matter wherein the tool moves bodily to-and-fro about an axis within the confines of the work.

- (1) Note. For a discussion of basic types of movement for the purposes of this group of subclasses, see (1) Note under the definition of subclass 67.

75 Spherical tool:

This subclass is indented under subclass 67. Subject matter wherein the tool is an element that is circular in all cross sections.

- (1) Note. Many disclosures in this subclass show a ball (or a plurality of balls) forced along the inside of a tube.

76 Work-hammering tool:

This subclass is indented under subclass 67. Subject matter wherein a tool engages the work with a sudden blow or impact.

- (1) Note. Many of the disclosures in this subclass show a plurality of tools surrounding (or surrounded by) work and delivering a quick succession of impacts to the work during the relative rotation of the tool and work. For similar structure wherein relative rotation does not occur, see subclass 402, wherein the tools surround the work, and subclass 393, wherein the work surrounds the tools.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 393, for similar structure including a tool that is surrounded by the work but does not involve relative rotation between the tool and work.
- 402, for similar structure including a tool that surrounds the work but does not involve relative rotation between the tool and work.

77 With tool surface orbiting around axis parallel to direction of travel of longitudinally moving work:

This subclass is indented under subclass 67. Subject matter wherein the work moves in the direction of its greatest dimension (i.e., lengthwise), and the tool* turns about a center of rotation that is parallel to the direction of work movement, whereby any specific portion of the tool face* travels helically relative to the surface of the work.

78 Including orbiting roller mounted on rotating carrier:

This subclass is indented under subclass 77. Subject matter wherein the tool is a roller* turning on an internal axis and is supported in a tool carrier* such that the roller axis revolves about said center of rotation.

79 Including deflectors arranged to provide undulating path for work:

This subclass is indented under subclass 77. Subject matter wherein the tool comprises a plurality of deflectors* positioned along the path of moving work in offset relationship, each of which deflectors forces each successively presented portion of the work from one direction into another direction in an arc extending partially around an axis-of-bend* that is disposed transversely of the path of work movement.

- (1) Note. See (1) and (2) Notes under the definition of subclass 160 for discussion of an undulating path “leveller”.

80 During rotation of work:

This subclass is indented under subclass 67. Subject matter wherein the work* clearly turns about its axis while deformation occurs.

- (1) Note. The expression “while deformation occurs” is intended to restrict this subclasses (80+) to disclosures wherein the work rotates at the time that deformation takes place. It is not intended to include disclosures wherein the work is rotated before or after deformation (e.g., indexing), which disclosures have been placed elsewhere, based on tool or work-handling structure.

81 With “pattern” causing movement of presser member:

This subclass is indented under subclass 80. Subject matter wherein a contoured guide member (e.g., “templet”) is engaged by a traversing follower connected to a tool such that the tool follows a path identical with the contours of the guide member as the tool engages the work for deformation thereof.

- (1) Note. See (1) Note under the definition of subclass 7.3 for further discussion of the term “pattern”.

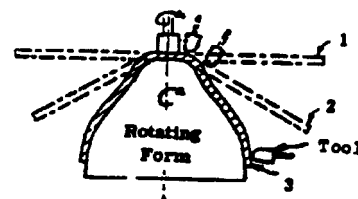
SEE OR SEARCH THIS CLASS, SUBCLASS:

- 7.3, for disclosure of a “pattern” that stimulates an activator to energize a control means.

82 Caused by work-holding, shape-imparting form (e.g., for “spinning”):

This subclass is indented under subclass 80. Subject matter wherein a member turns about an axis concentric (i.e., coincidental) with the work axis, which member has a profile, taken in cross section through the axis, corresponding to a cross-sectional profile of the product to be made, and the work* is disclosed as fixed to the member by a positively acting clamp to turn therewith at the same velocity, so that a tool can engage the work and deform successively presented portions thereof into contact with the profile of the member during turning of the work.

- (1) Note. The operation described is generally known in the art as “spinning”. See the Figure accompanying this note for an illustration of the operation. However, the term “spinning” in a patent is not sufficient basis for placing such a patent in this subclass (82).



The blank 1, an intermediate stage 2, and the product, 3, of a “Spinning” operation

SEE OR SEARCH THIS CLASS, SUB-CLASS:

115, for a disclosure wherein the member is stationary and cooperates with an orbiting or rotating tool.

83 With means causing cooperating presser member to traverse form surface:

This subclass is indented under subclass 82. Subject matter wherein the tool co-acts at any particular instant of time with a portion of the face of the turnable member and said tool is moved (a) relative to a point on the axis of said member and (b) along the face of the member.

(1) Note. This subclass (83) and subclass (85) below are the loci of patents disclosing generally similar concepts, but specifically different structure. In both subclasses a workpiece rotates together with a form or member, and a cooperating presser or tool deforms a continuous succession of circumferential portions of the work. As the tool traverses the work, it deforms a different succession of work portions during each 360° rotation of the work. However, in this subclass (83) the claimed disclosure includes means for, or a step of, holding of the work to the form, whereas in subclass 85 the traversing of the tool is emphasized.

84 Using tool having rotating surface moving along its axis of rotation during deformation:

This subclass is indented under subclass 80. Subject matter wherein a tool rotates on its axis of symmetry and simultaneously travels in a direction parallel to its axis.

85 And means causing tool to traverse surface of cooperating rotatable member:

This subclass is indented under subclass 84. Subject matter having a turnable member in addition to the tool, wherein the tool co-acts at any particular instant of time with a portion of the face of the turnable member and said tool is moved (a) relative to a point on the axis of said member and (b) along the face of the member.

(1) Note. See (1) Note under the definition of subclass 83 for a statement of the similarities and differences between this subclass (85) and subclass 83 structure.

86 Using angularly related roller couple acting parallel to axis of work rotation:

This subclass is indented under subclass 80. Subject matter including a roller couple* wherein the axes of the rollers of the roller couple are not parallel to each other, and wherein the roller couple is particularly adapted to opposingly engage the radial surfaces of a rotating disklike workpiece such that during metal deformation, the deforming forces of the rollers on the work are opposed to each other and are parallel to the work axis.

(1) Note. The term “disklike” used in this definition is intended to include an annular workpiece having radial surfaces opposingly engaged by the roller-couple. The product formed is usually the wheel of a railroad car, the wheel having a relatively thick, flanged rim connected to a hub by a relatively thin disc.

87 And additional work-engaging tool, circumferentially spaced about axis of work rotation:

This subclass is indented under subclass 86. Subject matter including at least one additional tool engaging the work for deformation thereof at an area angularly spaced about the work-axis from the area engaged (at any one instant) by the rollers of the roller-couple.

88 Caused by tools (e.g., “platens”) relatively moving parallel to their surface:

This subclass is indented under subclass 80. Subject matter wherein the work lies between two tools, each of which tools has a generally planar work-engaging surface, and wherein the work is rotated and deformed by moving one of the tools relative to the other so that the work-engaging surface of each tool moves relative to the other tool in a plane that is substantially equidistant from the generally planar work-engaging surface of the other tool during operation.

(1) Note. The term “generally planar” is intended to describe a tool comprising a

plate having a plurality of ribs and grooves therein, the tops of the ribs and the bottom of the grooves lying within or between substantially parallel planes.

89 Including rotating tool (e.g., “disk-platen”):
This subclass is indented under subclass 88. Subject matter wherein at least one of the tools rotates about an axis perpendicular to its planar surfaces.

90 Including stationary tool:
This subclass is indented under subclass 88. Subject matter wherein one of the tools is fixed against movement during metal deformation.

91 Causes by rotating tool and opposing concave surface:
This subclass is indented under subclass 80. Subject matter wherein the work lies between two tools, a first of which is a roller-like tool*, and a second of which tools has a non-planar work-engaging face that is curved about one or more centerlines adjacent and parallel to the axis of the first tool, so as to form a space of varying magnitude between the two tools.

92 Nonrotating concave surface:
This subclass is indented under subclass 91. Subject matter wherein the work-engaging face of the second tool is fixed against arcuate movement during deformation.

93 With means to adjust concave surface:
This subclass is indented under subclass 92. Subject matter including use of means to alter the position of the second tool relative to the roller-like tool.

94 And movement of work laterally of rotational axis during deformation:
This subclass is indented under subclass 80. Subject matter wherein the work moves bodily in a direction substantially at right angles to the axis of rotation of work during its rotation and deformation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

88+, for two tools relatively moving parallel to their surfaces that may move work laterally of its rotational axis during deformation.

91+, for rotating tool and opposing concave surface that may move work laterally during deformation.

95 And longitudinal movement of work:
This subclass is indented under subclass 80. Subject matter wherein the work rotates about an axis, and travels along said axis, which axis coincides with the direction of the greatest dimension of the work during its rotation and deformation.

(1) Note. In the operation of forming a screw-threaded element, the element may move along its length as a result of its rotation about its length dimension. Such lengthwise movements, caused solely by the element being screwed into a deformer, is specifically excluded from the limitations of these subclasses (95+). Disclosure of such movement may be found in subclasses 88+, 91+, and 103+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

77+, for disclosure of a tool orbiting about longitudinally moving work.

96 Using external rotating tool and internal core:

This subclass is indented under subclass 95. Subject matter including a first tool adapted to engage the inside of hollow material being deformed while substantially filling a cross-section of the cavity within such material, and also including at least one other tool adapted to turn about its axis and engage the outside of the material.

(1) Note. The term “hollow material” used in the definition of this subclass is intended to include work that is made hollow during the deforming operation.

97 Including work-piercing or work-expanding plug:

This subclass is indented under subclass 96. Subject matter wherein the first tool is provided with a portion that is, according to the total disclosure, particularly adapted to create an opening in the material (i.e., make the material hollow) or to enlarge an existing opening in the material during operation.

98 Using tool surfaces spaced along axis of work rotation:

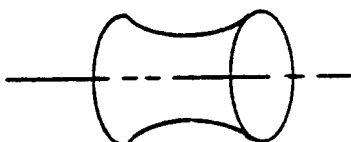
This subclass is indented under subclass 95. Subject matter including a plurality of tools placed at intervals along the direction of work travel.

- (1) Note. Many of the devices described in the patents of this subclass function to “straighten” rod-like work.

99 Using hyperboloidal roller:

This subclass is indented under subclass 95. Subject matter including a roller*, the work-engaging surface of which describes a symmetric concave curve approximating a hyperbola when the roller is viewed as a cross-section taken along the axis of the roller.

- (1) Note. An arc of a circle or ellipse, a parabola, or a similar symmetrical curved line is considered to approximate a hyperbola. The Figure accompanying this note illustrates a typical hyperboloidal roller.



100 Using tool cluster:

This subclass is indented under subclass 95. Subject matter involving a group of three or more tools disposed relative to the work and to each other in such manner that the tools engage the work in substantially a common plane.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 107, 110, 178, 194, and 224+, for other disclosures involving a roller-cluster or other-tool cluster.

101 Using rotating tool couple relatively adjustable about pivot normal to tool axis:

This subclass is indented under subclass 80. Subject matter including a tool-couple* comprising two tools, each of which turns on its

axis, and a tool-carrier* for supporting one of the tools, which tool-carrier is mounted to pivot about an axis extending in a direction substantially perpendicular to the axis of the tool supported thereby to position one tool relative to the other.

- (1) Note. The function of the structure described is usually (a) to permit work to be placed within the “bite” of the tool-couple prior to deformation, or (b) to vary the effect of the tool couple on the work during deformation thereof.

102 Using noncylindrical rotating tool:

This subclass is indented under subclass 80. Subject matter including a tool mounted to turn about an axis during metal deformation, the work-engaging surface of said tool being of a configuration that is other than a right circular cylinder.

- (1) Note. For the purpose of this definition, a right circular cylinder is formed by rotating a straight line about an axis that is parallel to the line. For placement in this or indented subclasses, a patent must claim a rotating tool having a surface that is significantly not a right circular cylinder. Examples of such configuration include: a cone, a helical (i.e., screwlike) groove, a barrel, and an hour-glass, among others.

103 Having helical groove:

This subclass is indented under subclass 102. Subject matter wherein the work-engaging surface of the tool is provided with a receding irregularity that could be traced by a point that runs continuously round and round the tool axis while constantly moving in one direction along the axis.

104 With cooperating tool rotating in same direction:

This subclass is indented under subclass 103. Subject matter wherein a plurality of tools*, at least one of which is helically grooved, coact to deform the same work, and wherein either (a) all the tools turn clockwise, or (b) all the tools turn counterclockwise.

- (1) Note. As disclosed in the patents of this subclass, the tools surround the work

and, as a result of the tools' rotation, cause the work to rotate in an opposite direction to that of the tools.

SEE OR SEARCH THIS CLASS, SUBCLASS:

108, for a similar arrangement of tools, but wherein the tools are shaped differently from those found herein.

105 And cooperating, complementary tool:

This subclass is indented under subclass 102. Subject matter including a second tool having surface portions that interfit with, or tend to interfit with, surface portions of the noncylindrical rotating tool, and wherein the tools coact on the same work.

106 And circumferentially spaced, work-engaging elements:

This subclass is indented under subclass 105. Subject matter including an additional member touching the work at a point on the work periphery that is angularly spaced about the work-axis from the cooperating tools, which additional member deforms or supports the work.

107 Included in roller cluster:

This subclass is indented under subclass 102. Subject matter wherein the tool is a roller*, including at least two additional rollers that cooperate with the first to form a roller-cluster*.

(1) Note. See the search note under the definition of subclass 100 for the loci of other disclosures that include use of a roller-cluster or a tool-cluster.

108 With cooperating tool rotating in same direction:

This subclass is indented under subclass 102. Subject matter wherein a plurality of tools* coact to deform the same work, and wherein either (a) all the tools turn clockwise, or (b) all the tools turn counterclockwise.

SEE OR SEARCH THIS CLASS, SUBCLASS:

104, for a similar arrangement of tools, and see (1) Note under the definition of subclass 104.

109 Including in tool couple:

This subclass is indented under subclass 102. Subject matter including a second tool cooperating with the first to form a tool-couple*.

110 Using roller cluster:

This subclass is indented under subclass 80. Subject matter including a roller-cluster*.

(1) Note. See the search note under the definition of subclass 100 for the loci of disclosures involving use of a roller cluster or a tool cluster.

111 Using tool couple:

This subclass is indented under subclass 80. Subject matter including a tool couple*.

112 Tool orbiting or rotating about an axis:

This subclass is indented under subclass 67. Subject matter including (a) a tool* that turns about an axis internal to both itself and the work, or (b) a tool that turns about a first axis internal to itself, and is mounted on a tool-carrier*, which tool-carrier turns about a second axis extending through the work.

(1) Note. The notes to subclass 67 define various movements disclosed in the patents of these subclasses (67+). Disclosure of a rotating tool (defined in (a) above) or an orbiting tool (defined in (b) above) will be placed in subclasses 112+. Disclosure of a gyrating tool (defined in subclass 67, (1) Note) will be placed in subclass 67.

113 Comprising transverse axis roller inside hollow work:

This subclass is indented under subclass 112. Subject matter wherein the tool is a roller* rotatable about its axis and is brought into engagement with the interior surface of hollow work* during deformation of the work, and wherein the roller axis lies across the length dimension of the hollow work.

(1) Note. Patents placed herein disclose the work to be, for example, a tube or pipe and the deforming tool to be a roller therein, the roller and the work being moved relative to each other in a direction having a component simultaneously

parallel to the centerline of the work and perpendicular to the roller axis. The deforming action is similar to that found in subclasses 199+, below, but the patents are placed here because the axis of rotation of the roller passes through the work.

114 Helically grooved tool threadedly engaging work:

This subclass is indented under subclass 112. Subject matter wherein the tool turns about an axis extending through the work, which tool is provided with an irregularity that could be traced by a point that runs continuously round and round the axis extending through the work while constantly moving along that axis, and which tool is adapted to slidably engage a portion of the work to rotate and move axially relative to that portion of the work.

- (1) Note. Most of the disclosures of this subclass show a device for applying a “blind rivet”, that is, a fastener applied to an object from only one side, the operation not requiring a pressure device applied to the opposite side of the object or the fastener.

115 Comprising movable tool cooperating with fixes, work-spaced tool:

This subclass is indented under subclass 112. Subject matter including a stationary member about which the tool orbits or rotates to cooperate with the member in such manner that only work is located between the tool in motion and the stationary member during operation.

- (1) Note. Included in this subclass are patents disclosing a fixed tool which supports the work and imparts all or part of its shape to the work as it coacts with the rotating or orbiting tool.
- (2) Note. The disclosures herein are similar to those in subclass 82 above with the difference that the movements of the parts are reversed, that is, whereas the work rotates in subclass 82 as it is “spun”, in this subclass (115) the tool orbits around stationary work.
- (3) Note. The phrase “only work is located between” is intended to include disclo-

sures wherein directly opposite surface portions of work are engaged by the tools. Thus, a disclosure wherein one tool engages an interior surface portion of a tube and the other tool engages the opposing exterior surface portion of that tube, would be placed herein. On the other hand, a disclosure wherein the tools contact chordally or diametrically opposite exterior surface portions of a tube would not fit this definition, since in the zone of deformation, a body of air occupies the space between the interior surface portions of the tube. This disclosure would be found in other subclasses, based upon the structure of the tools.

116 Plural, selectively usable fixed tools:

This subclass is indented under subclass 115. Subject matter wherein the stationary tool is one of a multiplicity of such tools alternately usable to cooperate with the tool that is in motion.

- (1) Note. Included in this subclass are patents disclosing a plurality of stationary tools of various sizes or shapes to accommodate variously sized or shaped workpieces and/or to produce products of varied size or shape.
- (2) Note. Usually the work is a tube which is to be flared or flanged at an end by diametrically outward pressure of an orbiting or rotating tool inserted into the tube end. The stationary tool coacts with the rotating or orbiting tool by clamping the tube around the exterior circumference, thereof, in generally opposed relation to the interiorly positioned orbiting or rotating tool, whereby at least a part of the shape of the stationary tool is imparted to the flared or flanged tube end.

SEE OR SEARCH THIS CLASS, SUBCLASS:

317, for similar apparatus wherein the inserted tool does not rotate.

117 Outwardly acting movable tool:

This subclass is indented under subclass 115. Subject matter wherein the tool in motion is at least partially encompassed by the work so that

the movable tool acts on work tending to force a portion of the work radially outwardly from the axis of tool rotation extending through the work.

118 Including tool surface spaced along orbital axis:

This subclass is indented under subclass 112. Subject matter including a rotating tool (or tools) having a plurality of faces engaging the work for deformation thereof, wherein the work-engaging faces are separated by an interval measured parallel to the orbital or rotational axis.

- (1) Note. Included, for example, in this and indented subclasses are patents disclosing a first tool face which exerts an outward pressure on a portion of the interior surface of a tube to produce a circumferentially expanded area (i.e., rib or bead), and a second tool face which forms a flange or flared area at the end of the tube. In most cases, the two tool faces are mounted at different positions on a rotating tool carrier*, which positions are longitudinally separated with respect to the orbit axis. The first and second faces may be longitudinally separated portions of the same tool.
- (2) Note. In many of the patents in this and the indented subclass, a pipe is disclosed as being joined to an apertured plate by passing the pipe through the plate aperture and the deformations described in (1) Note are positioned on opposite surfaces of the plate whereby the pipe is prevented from shifting axially relative to the plate. However, patents wherein the most comprehensive claim recites structure that, by disclosure, recognizes the pipe and structure that, by disclosure, recognizes the plate (i.e., “assembly”) will be found in Class 29, subclasses 243.517+ and 726.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 243.517+ and 726, and see (2) Note above.

119 Including plural tools rotating on angularly related axes:

This subclass is indented under subclass 118. Subject matter including a plurality of rotating tools turning about separate nonparallel axes.

120 With actuation of tool radially:

This subclass is indented under subclass 112. Subject matter wherein the tool is moved toward or away from the axis of turning during deformation.

- (1) Note. The phrase “during deformation” is intended to include disclosures wherein a means to actuate the tool is operative at the same time that the tool is deforming the work. Disclosures wherein a tool moving means is operative before or after the deformation (e.g., adjusting means) would not fit this definition and would be found in other subclasses based upon the structure of the tools.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 726, and see (2) Note under the definition of subclass 118 above.

121 Wherein tool is actuated inwardly:

This subclass is indented under subclass 120. Subject matter wherein the tool is pressed toward the axis during deformation.

- (1) Note. The term “pressed” is intended to include structure for forcing the tool against the work, towards the axis, even though the tool may itself move away from the axis to conform to the shape of the desired product.

122 Including rotating tool mounted on rotating carriers:

This subclass is indented under subclass 120. Subject matter wherein the tool* turns about its own rotational axis in a tool carrier*, which tool carrier turns about a second axis extending through the work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 126, for disclosure similar to that herein (122), but not provided with means

for moving the tool radially of the second (i.e., “orbital”) axis during deformation.

123 Including roller having noncylindrical work-engaging surface:

This subclass is indented under subclass 122. Subject matter wherein the work-engaging face of the rotating tool* is a peripheral surface generated by a line revolving about an axis wherein the line is either not straight or not parallel to the axis.

- (1) Note. This subclass is the locus of patents disclosing a roller tool which is not a right circular cylinder.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 102, for disclosure of similarly shaped tool structure in which disclosure the work rotates.

124 Comprising roller cooperating with work-spaced tool:

This subclass is indented under subclass 112. Subject matter wherein the orbiting or rotating tool is a roller* and including a second tool* cooperating with the roller such that only work is located between the tools during deformation.

- (1) Note. See (3) Note under the definition of subclass 115 for discussion of the phrase “only work is located between”.

125 With work or tool locator or work clamp:

This subclass is indented under subclass 112. Subject matter including means for positioning the work relative to the tool* and/or for holding the work relative to the tool.

- (1) Note. See “Work-Gripping Clamp” in the Glossary of Terms.
- (2) Note. Included herein are patents disclosing a means to measure (i.e., gage) the positions of the tool and the work with respect to each other.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 281.1+ for structure wherein the device positions one part of a subassembly relative to

another part prior to, or during, the securing of the parts by deformation.

126 Tool both orbits and rotates:

This subclass is indented under subclass 112. Subject matter wherein the tool turns about an internal axis and said axis revolves about a second axis that extends through the work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 122, for a disclosure wherein the tool is moved toward or away from the second (i.e., “orbital”) axis during deformation.

127 BY DEFLECTING SUCCESSIVELY PRESENTED PORTIONS OF WORK DURING BODILY MOVEMENT THEREOF (E.G., FOR COILING, LEVELLING, CURVING, OR TROUGHING MATERIAL IN MOVEMENT):

This subclass is indented under the class definition. Subject matter including an instrumentality, or step of using an instrumentality, into which work is serially introduced in an original direction along a path, and which instrumentality functions to divert the work away from such path in conformance to either of the following limitations:

- (a) longitudinally consecutive quanta of work are totally diverted from the original path to a new path about an axis-of-bend* transversely disposed with respect to the original direction; or
- (b) longitudinally consecutive cross sections of work (the cross sections being taken at right angles to the original direction and each cross section having width and breadth dimensions) pass through the instrumentality, and one of the dimensions of the consecutive cross sections is diverted about at least one longitudinally extending axis-of-bend with substantially no change in the magnitude of either dimension.
- (1) Note. The “original direction” is established by considering the movement of the work portions that are at the entrance to the work-deforming instrumentality. Having established an “original direc-

tion” with respect to the work at the entrance, the longitudinal dimension of work is deemed to be that which is moving in such direction regardless of the extent of that dimension or of the course of movement of any portion of undeformed material (i.e., work portions moving in that direction are “longitudinally consecutive”). Thus, if a piece of work having a short width and a long length moves into the instrumentality along its width dimension “longitudinally consecutive” portions of that work-piece extend along the width dimension. As another example, if the metal is coiled or curved and successive portions thereof move in a spiral or helical path into a straightening device, the “original direction” (established at the device) extends spirally or helically upstream of the device and the portions are deflected from the spiral or helical path into a straight path.

- (2) Note. The definition of axis-of-bend in the Glossary of this class is accompanied by drawings, Figures III-1 to III-5, illustrating the products of the devices discussed in (3) Note which follows. The term “quanta of work” (used in part (a) of the definition) refers to portions or masses of work, each portion having dimensions that are (a) infinitesimal in the longitudinal direction, (b) equal to work thickness, and (c) equal to or less than work width.
- (3) Note. The following types of patent disclosures are exemplary of those placed as original copies in this and indented subclasses (all patents have in common a disclosure that work is moved along an original course of movement):

(a) a device for deflecting a strand (or strip) entirely around an axis-of-bend to form; a helical tube (illustrated in the Figure accompanying (1) Note in subclass 49), or a helical coil (illustrated in Figure III-3 in the definition of axis-of-bend*), or a spiral coil (illustrated in Figure III-2 in the definition of axis-of-bend), the product retaining the shape imparted thereto by the deflector;

(b) a device for “levelling” (i.e., straightening) work by moving it along a general course but deflecting each successive portion first in one direction (partially around a first axis-of-bend) and then in another direction (partially around another axis-of-bend) through an undulating or tortuous path along the general course (illustrated in Figure III-4 in the definition of axis-of-bend), wherein the work moves in its entirety past a group of deflectors and each successive work portion moves in the same undulating path;

(c) a device wherein the cross-sectional configuration of the work is reshaped by bending about a longitudinal axis-of-bend so as to form a trough (illustrated in Figure III-5, see the definition of axis-of-bend*) or a longitudinally corrugated product (illustrated in Figure 2 accompanying (1) Note of subclass 180); or

(d) a device wherein a coil is rotated about its central axis and the convolutions thereof are unwound and straightened by deflecting successive work portions partially around an axis-of-bend that is parallel to the coil axis and outside the coil (this operation being the converse of the coiling described in paragraph (a) herein above).

- (4) Note. A full discussion of the differences between the structure and function of patents for this class (72) and the patents for Class 242, Winding, Tensioning, or Guiding will be found in Lines With Other Classes, Other Class Relationships, and References to Other Classes, of this class definition (72)
- (5) Note. With respect to paragraph (b) of the definition of this subclass (127), the term “deflecting” is limited to bending without change in the cross-sectional area of the material as the work is deformed. If the product of a deforming operation has a cross-sectional area greater than or less than that of the work entering the deforming instrumentality, the deformation is not considered to be a

deflecting operation. Such deformation may be found in subclasses pertaining to the reduction of size, as for example, subclasses 199+ wherein a roller-couple reduces the cross-sectional area of the work; subclasses 274+ wherein the area of work is reduced by “drawing” through a die, and subclasses 343+ wherein a sheet is “drawn” into a shell or cup.

SEE OR SEARCH CLASS:

428, Stock Material or Miscellaneous Articles, subclass 603 for metallic stock of nonplanar uniform thickness or nonlinear uniform diameter.

128 With modification or control of temperature or work, tool or machine:

This subclass is indented under subclass 127. Subject matter including a step of, or means for, changing or regulating the degree of heat content of the work*, the deflector* or any part of the deforming instrumentality wherein the deflector functions.

- (1) Note. Included within the concept of “regulating” is preventing the temperature from changing. For example, a cooled bearing in the machine, or a heated deflector operating on hot work, will warrant original placement of a metal deflecting patent having such claimed structure into this subclass (128).
- (2) Note. The schedule of this class (72) contains other subclasses pertaining to temperature modification or control in other deforming operations.

129 With cutting of work or product:

This subclass is indented under subclass 127. Subject matter including a step of, or means for cutting the work* for, or product* of, or deflecting operation.

- (1) Note. Patents disclosing cutting placed originally in this subclass (129) and indented subclasses are limited to that cutting described in Lines With Other Classes, Relationship to Combination Classes, With Cutting, of this class.

- (2) Note. The schedule of this class (72) contains other subclasses pertaining to cutting with other types of deforming operations.

130 And deforming of work or product (other than by deflecting):

This subclass is indented under subclass 129. Subject matter including a step of, or means for, additionally deforming metal in some manner differentiated from deflecting.

- (1) Note. This subclass will take a disclosure of deflecting plus cutting plus deforming wherein the deforming is, per se, classified below subclass 184.

131 And stopping of work movement during cutting:

This subclass is indented under subclass 129. Subject matter wherein the cutting of the work is done only while the work is stationary.

132 And actuation of cutter in timed relation to deflector or work movement:

This subclass is indented under subclass 129. Subject matter wherein the cutting is done in synchronism with the deflecting or feeding of the work.

- (1) Note. Included within the concept of the term “in synchronism” is a device wherein the cutter is driven from the same power source that also drives the deflector or the work feeder such that the operation of the elements is clearly inter-related.

133 With feeding of discrete articles or orienting of work relative to deflector (other than by deflector):

This subclass is indented under subclass 127. Subject matter relative to deflector including means for presenting work having a determinate length to a deflector*, or for positioning work laterally with respect to the deflector, which means does not itself work.

- (1) Note. An instrumentality of the type which characterizes the patents of subclasses 127+ is usually “self-feeding”, that is, it pulls the work through or within the deforming instrumentality as

it deforms the work. A patent disclosing or claiming a self-feeding deflector will not be placed as original in this subclass (133) but will be placed in accordance with the deflector structure.

134 With use of means to remove product from deflector:

This subclass is indented under subclass 127. Subject matter including use of means for positively moving product* away from a deforming instrumentality.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 169, for structure which may be removed or partially disassembled to permit product removal from deflecting instrumentality.
- 250, 257, 328, 361, and 426+, for other product handling.

135 To form helical coil or tube:

This subclass is indented under subclass 127. Subject matter wherein the instrumentality accomplishes, or is provided with additional means that accomplishes, a further diversion of the successively presented portions along the transversely disposed axis-of-bend*, thereby adding a helical pitch to the produced coil*.

- (1) Note. It will be noted that the “transversely disposed axis-of-bend” is referred to in paragraph (a) of the definition of subclass 127.
- (2) Note. The diversion of the work around the axis-of-bend, and the diversion along said axis can be accomplished by separate devices or by a single mechanism that combines the functions of both devices.
- (3) Note. For illustrations of a tube and a coil, see the Figure accompanying (1) Note of subclass 49, and Figure III-3 (in the definition of axis-of-bend*), respectively.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 49, for the manufacture of a helically-seamed tube.

- 371, for a method of coiling not involving the use of any particular structure.

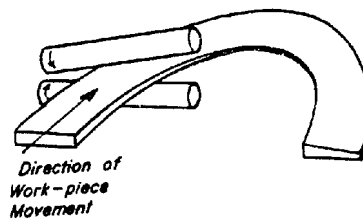
SEE OR SEARCH CLASS:

- 428, Stock Material or Miscellaneous Articles, subclass 592 for a metallic stock which is helical or has a helical component.

136 Including thinning of helical portion of work section:

This subclass is indented under subclass 135. Subject matter wherein the instrumentality comprises two elements: (a) having work-engaging surfaces extending transversely across the direction of movement of the work, and (b) engaging opposite faces of the work, and in which as claimed or disclosed, the distance between the work-engaging surfaces is less at one side margin of the work than at the other side margin thereof, and also less than the original work thickness.

- (1) Note. Usually a deflector* of this class (72) includes a member inclined to the direction of travel of moving work, which member engages a side to divert the work into a coil. In this subclass (136) the coiling is the result of the work being squeezed between two pressure surfaces (e.g., rollers, hammers, etc.), between which the work passes. The squeezing of one side margin elongates the squeezed margin with respect to the other margin, thereby effectively causing a deflection out of the course of work movement. See the Figure accompanying this note for illustration of pressure surfaces comprising rollers*.



SEE OR SEARCH THIS CLASS, SUB-CLASS:

167, for similar structure wherein the work is merely curved as distinguished from coiled.

SEE OR SEARCH CLASS:

428, Stock Material or Miscellaneous Articles, subclass 592 for metallic stock which is helical or has a helical component.

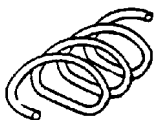
137 With deforming of work or product (other than by coiler):

This subclass is indented under subclass 135. Subject matter further provided with means for deforming work, which means functions in a manner different from the instrumentality defined in subclass 135.

138 By use of means acting by and during machine operation to form coil of irregular pitch and/or diameter:

This subclass is indented under subclass 135. Subject matter including use of means to produce a coil that is not uniform as to its helix angle (i.e., pitch) or its radius of arc (i.e., diameter) or both, which means is driven from the same power source that causes deflection of the work into a coil, and operates while the deformation occurs.

- (1) Note. The structure defined facilitates the production of a helical coil in other than regular cylindrical form. The coil shown in the Figure accompanying this note is the result of changing the radius of bending during manufacture.



- (2) Note. Also placed in this or indented subclasses would be a disclosure of a machine for producing a coil of nonuniform pitch or nonuniform diameter (e.g., an "hour-glass" configured bed spring), or a machine for varying the radius of

the coil convolutions as the coil is being produced.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

140, and 143, for means for adjusting an instrumentality to produce coils of different pitch and/or diameter.

139 Including noncylindrical core:

This subclass is indented under subclass 138. Subject matter wherein the coil-changing means includes an arbor that has a configuration other than that of a right circular cylinder.

- (1) Note. Patents placed herein include those disclosing a mandrel having (for example) a conical shape or a noncircular cross section onto which the work is deflected, and from which the coil acquires its shape during deformation of the work into a coil.
- (2) Note. For a discussion of "right circular cylinder", and examples of structure that is not a right circular cylinder, see (1) Note under the definition of subclass 102.

140 By interchangeable or selectable tool portion:

This subclass is indented under subclass 135. Subject matter including means on or within the instrumentality permitting (a) substitution of another diverting means therein, or (b) use of another work-engaging portion of the diverting means.

141 By multiconvolutional tool:

This subclass is indented under subclass 135. Subject matter wherein the instrumentality that engages and diverts successively presented portions of the moving work continues to engage and guide the produced coil through more than 360° of movement of said portions around the axis-of-bend*.

- (1) Note. Patents placed in this subclass disclose a deflector, pitch-adder tool having a helically-shaped path that confines the produced coil to movement within that path.

142 By work guide and rotatable work-holding core:

This subclass is indented under subclass 135. Subject matter wherein the instrumentality comprises: (a) an arbor having claimed or disclosed means thereon, or cooperating therewith, for temporarily securing the work relatively thereto; and (b) means adjacent to, and cooperating with, the arbor and directing the work to or towards the peripheral surface of the arbor in which the arbor turns about its central axis.

- (1) Note. Patents in this and indented subclasses disclose the pitch adder as an arrangement wherein the core (i.e., the arbor of (a) above) and the work-guide (i.e., the work-directing means of (b) above) are relatively movable. Pitch is added to the product by moving the core along its axis or by traversing the work-guide along a line parallel to the axis; see subclass 144 indented hereunder for the traversable work-guide.

143 Add means to change pitch of coil:

This subclass is indented under subclass 142. Subject matter including means for altering the effect of the pitch adder on the successive work portions, whereby the pitch of the produced coil is altered.

- (1) Note. For discussion of “pitch” see the definition of coil* in the Glossary of this class.
- (2) Note. Included in this subclass are patents disclosing means for moving the core and/or the work guide relatively along, or parallel to, the core axis, and means for changing the relative movement. The change is made while the instrumentality is not operating.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 138, for a disclosure of adjustment of pitch and/or diameter during machine operation, and see (2) Note above.

144 And means to traverse work guide:

This subclass is indented under subclass 142. Subject matter including mechanism for moving the work guide uniformly along a line parallel to the core axis.

- (1) Note. The work guide and the core are discussed in (b) and (a) respectively, in the definition of subclass 142, above.

145 By movable periphery tool external of coil:

This subclass is indented under subclass 135. Subject matter wherein the instrumentality includes a work-engaging surface (or group of surfaces) facing the axis-of-bend*, wherein the surface(s) moves relatively to said axis and also moves with the deflected product portions during coiling.

- (1) Note. The surface may be driven, or may be moved solely by frictional contact with the moving work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 49+, for disclosure of tube-seaming apparatus showing use of one or more rollers outside of the tube that is being produced.

146 To form spiral coil:

This subclass is indented under subclass 127. Subject matter wherein the instrumentality diverts work around a transverse axis-of-bend* to produce a coil* having a plurality of radially superimposed convolutions or whorls.

- (1) Note. See Lines With Other Classes, Other Class Relationships, Class 242, of this class (72) for the differences between the subject matter of this subclass (146) and the subject matter of Class 242.

147 With interposes of space adjacent coil convolutions:

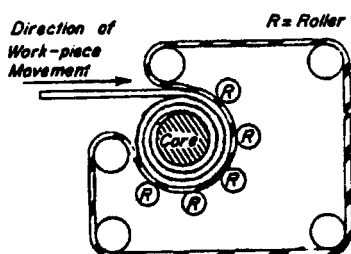
This subclass is indented under subclass 146. Subject matter wherein a member (or plurality of members) is (or are) moved with the work or product into contact with a whorl of deflected product to separate each whorl from the previously deflected whorl and the next deflected whorl.

- (1) Note. This subclass (147) will serve as a locus of cross-reference patents disclosing the making of a metal open spiral coil (i.e., a coil, similar to a balance spring, having spiral convolutions wherein successive convolutions do not contact one another.

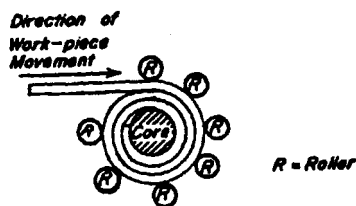
148 With core inside coil:

This subclass is indented under subclass 146. Subject matter wherein the work is deflected onto an arbor to form the convolutions of the coil.

- (1) Note. The Figures below illustrate two exemplary forms of “blocker and core” used to start the winding of a strip around a core or arbor. In one form a belt (backed by rollers) surrounds the core; in the other, rollers (without the belt) urge the first convolutions of a strip around the core.



Belt Blocker and Core



Roller Blocker and Core

149 By use of work-contacting wiper and moving, work-holding form:

This subclass is indented under subclass 127. Subject matter wherein the instrumentality comprises: (1) a first member adjacent the work and engaging a surface thereof, to con-

fine the work to movement along its original direction, and cooperating with (2) a second member movable in an arc about an axis-of-bend*, which axis-of-bend is disposed transversely of the direction of work movement, said second member having: (a) a peripheral surface tangent to said course and along which surface the work is to be laid thus imparting the shape of the surface to the product, and (b) means for temporarily securing a portion of said work to said surface so that the secured portion partakes of all movement of said second member, while trailing portions are constrained by the first member and the work is deformed by and between the two members.

- (1) Note. The first (i.e., work-engaging) member is usually referred to in the art, and will hereinafter be referred to in these definitions, as a “wiper”. The second (i.e., work-holding) member is usually referred to in the art, and will hereinafter be referred to in these definitions, as a “former”.

- (2) Note. In operation, the work is held to the form tangent to the surface thereof and the form is rotated, usually through less than 360°. In the absence of a wiper the work would revolve around the form with its lead end tangent thereto; however, the wiper is used to confine the underformed work portions to their original direction of movement. The work-gripping form thus pulls the work with the form surface as the form rotates, deflecting the gripped work portion and successive portions away from the course and partially around the axis-of-bend, and the wiper acts on successively presented work portions to urge the work into contact with successive portions of the form surface.

150 With core inside hollow workpiece:

This subclass is indented under subclass 149. Subject matter including a member that substantially contacts all of the interior periphery of that section of hollow work* that is engaged by the deforming instrumentality.

- (1) Note. The core disclosed in the patents in this subclass usually functions to prevent

undesired distortions in tubular work during the bending thereof.

151 With tensioning or work:

This subclass is indented under subclass 149. Subject matter including use of means for applying a tensile stress to the work during the deflecting thereof.

- (1) Note. The tensioning is usually by a structure, additional to the wiper and former, that would tend to pull the work rearwardly except for the greater effect of the former that pulls the work to itself. However, this subclass (151) is also a locus of patents disclosing a wiper and former plus a “drag” or “brake” on the work that tends to retard work movement, thereby applying a tension to the work.
- (2) Note. As work is bent by deflection, that side of the material facing the axis-of-bend* is placed under compression whereas the opposite side is placed under tension. The “tension” described in this (2) Note is not sufficient to warrant placement of a patent into this subclass.

152 With deforming or work or product (other than by wiper and former):

This subclass is indented under subclass 149. Subject matter further including a deforming means other than that peculiar to subclass 149.

153 And means to impart compound motion to form:

This subclass is indented under subclass 149. Subject matter including means for moving the form simultaneously (a) in its rotation about the axis-of-bend*, and (b) in its translation in a direction at right angles to said axis.

154 Including back-up travelling wiper (e.g., follow bar):

This subclass is indented under subclass 149. Subject matter wherein the wiper comprises a first element engaging the surface of the work and moving therewith either along or parallel to the course of movement thereof, and a second element applying force at right angles to both the course and the axis-of-bend*, the sec-

ond element thereby urging the first element into engagement with the workpiece.

- (1) Note. The purpose of this structure is to prevent sliding contact between the wiper and the work. Since the travelling wiper moves with the work, the surface of the work is thus not marred by the wiper.

155 And means to urge wiper toward form surface:

This subclass is indented under subclass 149. Subject matter including means for biasing the wiper toward the form.

- (1) Note. The terms “wiper” and “form” are defined in the definition and notes of subclass 149.
- (2) Note. A patent disclosing a wiper, the position of which is adjusted before deflection, but unchanged during deflection, will not be placed in this or indented subclasses. See subclass 158 for such adjustable wiper.
- (3) Note. Included in this subclass (155) are patents disclosing, for example, lever means, hydraulic means, or spring means as the blasting force.

156 And interrelated means to move form and gripper element thereon:

This subclass is indented under subclass 149. Subject matter wherein (a) the work-holding means and the form includes a part movable with respect to the form, for securing the work to the form, and includes mechanism to move the part, and (b) there is also included a mechanism for moving the form, and wherein the part moving mechanism and the form-moving mechanism are connected together or are moved in synchronous relationship one to the other.

- (1) Note. In usual operation the mechanisms are actuated by a drive means common to both, such that first the work is gripped and then the form is moved.

157 Including interchangeable or adjustable wiper or form:

This subclass is indented under subclass 149. Subject matter including means permitting either: (a) by substitution of another wiper or another form, or a portion of either member, or (b) by variation in the position of the wiper relative to the form of the work.

158 Comprising adjustable wiper:

This subclass is indented under subclass 157. Subject matter wherein the position of the wiper is alterable at will.

- (1) Note. Included in this subclass (158) are patents wherein the wiper is adjusted closer or further from the form to accommodate work of different size, or wherein the wiper is repositioned to change the direction of bending of the work.

159 And work-complementing gripper faces (e.g., contoured):

This subclass is indented under subclass 149. Subject matter including work-holding elements on the form, said element having surfaces which are nonplanar and match or fit corresponding surfaces of the gripped portion of the workpiece.

- (1) Note. The “work-holding elements” were described in the definition of subclass 149 in part (2) section (b) as means for temporarily securing the work to the form. In this subclass (159) are found disclosures of gripper elements for gripping threaded pipe, flared tubing, I-beams, or other objects having a contoured cross section.

160 By use of deflected arranged to provide longitudinally undulating path for work (e.g., “levelling”):

This subclass is indented under subclass 127. Subject matter wherein the instrumentality includes a plurality of deflectors* positioned along the path of moving work in offset relationship, each of which deflectors forces each successively presented portion of work from one direction into another direction in an arc extending partially around an axis-of-bend*

that is disposed transversely of the path of work movement.

- (1) Note. Included in this and indented subclasses are patents disclosing operations known in the art as “straightening” and “levelling”. These patents have a plurality of deflectors located adjacent a course of work movement along a straight line from entrance end to exit end of the instrumentality. At least one of the deflectors is intruded into the line from one side and another deflector is adjacent to, or intruded into, the line from another side.

As the work passes along the successive deflectors, any specific work portion will move along the course, be deflected in one direction by a first deflector, and that specific portion will be deflected in another direction by another deflector. The work within the instrumentality is engaged by a plurality of deflectors simultaneously, so that at any instant of time the work has formed therein a plurality of deflected portions similar in shape to a “roller coaster” track extended into a single compass direction. However, each specific portion passes through a sinuous path. In many disclosures it is clear that the amplitude of the deflections is greatest at the entrance end of the device and least (or zero) at the exit end thereof, so that at the exit end the product is straight or planiform. An illustration of a typical “leveller” appears in Figure III-4 under the definition of axis-of-bend* in the Glossary of this class.

- (2) Note. Patents placed originally in this and indented subclasses disclose an operation wherein a stress is applied to work because of, and during, its passage through an undulant path. See the disclosures of subclass 205 for an undulant path “tension bridle” as a retarding means in a roller couple system.

SEE OR SEARCH THIS CLASS, SUBCLASS:

205+, and see (2) Note above.

- not providing or causing an undulant path.
- 161 With deforming of work or product (other than levelling):**
This subclass is indented under subclass 160. Subject matter, further provided with means for deforming work, which means functions in a manner different from the instrumentality defined in subclass 160.
- 162 Including relatively inclined successively rollers:**
This subclass is indented under subclass 160. Subject matter including a first-acting roller* and a second-acting roller positioned so that, even viewed along the direction of work movement, the axes of the rollers overlies in crossing relationship (i.e., their projections intersect on a plane perpendicular to the line of sight).
- (1) Note. Some patents in this subclass (162) disclose rollers arranged in two (or more) groups including a first group having rollers on vertical axes and another group having rollers on horizontal axes.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
235, for similar structure including successive roller couples angularly related, but not providing an undulant path.
- 163 And back-up means for roller deflector:**
This subclass is indented under subclass 160. Subject matter wherein the instrumentality has a plurality of rollers* for deflecting work, and the rollers are supported against movement at right angles to the axes thereof by means located between the ends of the work-engaging surfaces of the rollers and in contact therewith.
- (1) Note. The deflecting rollers engage the work and are between the work and the back-up means. The pressure exerted by the work in resisting deformation is transmitted through the rollers to the back-up means, rather than being absorbed by the rollers along.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
241.2+, for disclosure of similar back-up means in a roller couple carrier and
- 164 And adjustable carrier for deflector:**
This subclass is indented under subclass 160. Subject matter wherein one or more of the deflector(s)* is (are) supported in a tool carrier* and the tool carrier is mounted so that its position within the instrumentality may be altered.
- 165 Including tier or roller deflectors on carriers:**
This subclass is indented under subclass 164. Subject matter wherein a tool carrier* is located on one side of the course of work movement and supports a plurality of rollers* therein.
- 166 By use of deflectors arranged to bend work longitudinally of direction of work movement:**
This subclass is indented under subclass 127. Subject matter wherein the instrumentality diverts successively presented work portions from their original direction into an arcuate second direction at least partially about an axis-of-bend* that is disposed transversely of said original direction.
- 167 Including thinning portion of work section:**
This subclass is indented under subclass 166. Subject matter wherein the instrumentality comprises elements (a) having work-engaging surfaces extending transversely across the direction of movement of the work, and (b) engaging opposite faces of the work, and in which, as claimed or disclosed, the distance between the work-engaging surfaces is less at one side margin of the work than at the other side margin thereof, and also less than the original work thickness.
- (1) Note. See subclass 136 and the Figure accompanying (1) Note therein for further discussion of the apparatus and an illustration of an exemplary form thereof.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
136, for similar structure plus a pitch adder wherein a helical coil is formed, and see (1) Note above.

168 With deforming of work or product (other than bending longitudinally):

This subclass is indented under subclass 166. Subject matter further provided with means for deforming work, which means functions in a manner different from the instrumentality defined in subclass 166.

169 With handling of curved product:

This subclass is indented under subclass 166. Subject matter including means, additional to the instrumentality, for manipulating the product* within the instrumentality; or including means disclosed as permitting the product to be manipulated within, or removed from, the instrumentality.

- (1) Note. In many patents, there is a teaching that the product is wrapped around a core which is supported at both ends and is mounted so that the instrumentality may be partially disassembled to permit removal of the product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 134, for means to remove the product from the instrumentality.

170 Including three concurrently acting delta-arranged deflector elements:

This subclass is indented under subclass 166. Subject matter wherein the instrumentality comprises an integrated assemblage of three (or more) members acting at the same time on the moving work, wherein two members are located so as to be spaced along one side of the course of work movement and a third member is located on another side of said course.

- (1) Note. Included in this and indented subclasses are patents disclosing such exemplary roller arrangements as those known in the art as "pyramid" rollers, illustrated in Figure 1 accompanying this note, and those known in the art as "pinch" rollers, illustrated in Figure 2 accompanying this note. The difference between the two exemplary arrangements is, as illustrated, the spacing between rollers. In view of the fact that few patents claim this different spacing no subclasses based upon this difference

have been established. In either of these arrangements the "downstream" roller may be replaced by a plate, block, or other similar member which the work engages and on which it slides, as illustrated in Figure 3 accompany this note. Patents disclosing structure similar to this illustration (Figure 3) will be found in subclass 172 below.

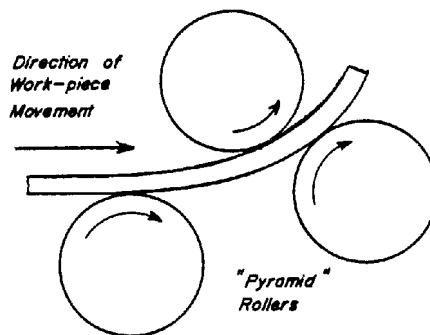


Figure 1

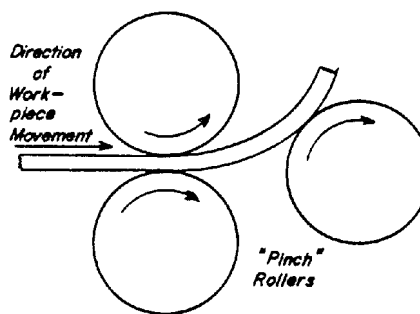


Figure 2

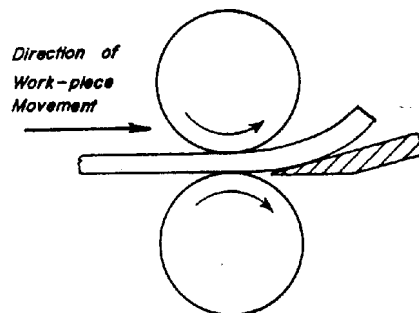


Figure 3

171 And additional work-deflecting or working-constraining element:

This subclass is indented under subclass 170. Subject matter including use of a member additional to such three members (defined in and required by subclass 170) which additional member engages the work and guides, or deflects, or supports the work as it is acted upon by the three members.

- (1) Note. Include herein subclass (171) are patents disclosing the fourth member as constraining the work by preventing its re-entry into contact with the three members.

172 Comprising two rollers and guide:

This subclass is indented under subclass 170. Subject matter wherein the three members consist of two rollers* and a third, passive member, which is not a roller, engaging and acting on the work, while remaining stationary.

- (1) Note. Excluded from this subclass are patents disclosing the third member to be a roller* rotatable about its axis. Such patents will be found elsewhere, for example, in subclass 170.
- (2) Note. For an illustration of the type of structure found in this subclass, see Figure 3 accompanying (1) Note of subclass 170.

173 Including adjustable element:

This subclass is indented under subclass 170. Subject matter wherein the position of at least one of the members relative to the other member(s) may be altered.

- (1) Note. The deflecting member is usually held in an adjustable tool carrier*.

174 And interrelated means to adjust plural elements simultaneously:

This subclass is indented under subclass 173. Subject matter including two or more adjustable members, and further including means for altering the position of all of the adjustable members by a drive means common to all.

- (1) Note. In accordance with the definitions of subclass 173 and this subclass (174), a

disclosure of a single adjustable tool carrier* holding two or more deflectors would be placed herein subclass (174) since all the deflectors are adjusted at the same time.

175 Comprising rectilinearly reciprocable carrier for element:

This subclass is indented under subclass 173. Subject matter wherein the adjustable member is held in a tool carrier* which is movable to and from the work along a straight line.

176 By use of deflector arranged to bend work transversely of direction of work movement (e.g., troughing):

This subclass is indented under subclass 127. Subject matter comprising an instrumentality which functions to divert work in conformance with the limitations expressed in paragraph (b) of the definition of subclass 127.

- (1) Note. See the definition of axis-of-bend, and Figure III-5 therein, for further discussion and illustration of one of the products formed by the structure of this and indented subclasses.
- (2) Note. In accordance with (5) Note under the definition of subclass 127, bending caused by, or accompanied by a reduction in the cross-sectional area of a workpiece is not to be found in this or indented subclasses.

SEE OR SEARCH CLASS:

228, Metal Fusion Bonding, subclass 147
for a method of making a tube by skelping it and welding the tube seam.

177 With deforming of work or product (other than bending transversely):

This subclass is indented under subclass 176. Subject matter further provided with means for deforming work, which means functions in a manner different from the instrumentality defined in subclass 176.

178 Including roller cluster:

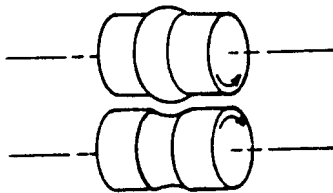
This subclass is indented under subclass 176. Subject matter wherein the instrumentality includes three or more cooperating rollers* that form a roller cluster*.

- (1) Note. See the search note under the definition of subclass 100 for the loci of disclosures involving use of a roller cluster or a tool cluster.

179 Including complementary roller couple:

This subclass is indented under subclass 176. Subject matter wherein the instrumentality includes two noncylindrical rollers disposed so that their axes lie in a common plane and work passes through (intersects) said plane between work-engaging surfaces of the rollers, and wherein, at that plane, the surface of one roller interfits (or tends to interfit) with the surface of the other roller.

- (1) Note. The Figure accompanying this note illustrates one example of a complementary roller couple.



180 Including plural axially spaced circumferential ribs and grooves:

This subclass is indented under subclass 179. Subject matter wherein the profile of each roller (i.e., the outline of the roller's work-engaging surface at the plane) is an undulant line (i.e., is alternately convex and concave relative to the roller axis) and wherein the convexities and concavities of one roller profile interfit (or tend to interfit) with the concavities and convexities respectively of the other roller profile.

- (1) Note. Figure 1 accompanying this note illustrates one example of a ribbed and grooved complementary roller-couple. An example of the product of this roller-couple is illustrated in Figure 2 accompanying this note.

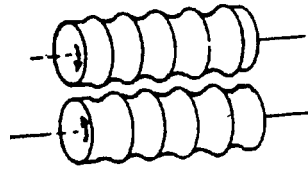


Figure 1. Direction of Work-piece Movement.

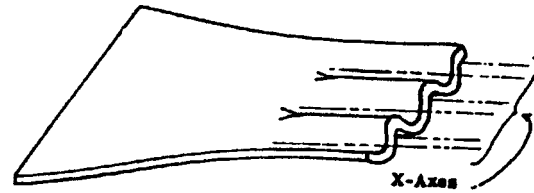


Figure 2. Direction of Work-Piece Movement.

181 Including plural successively acting roller couples:

This subclass is indented under subclass 179. Subject matter wherein two or more roller couples*, at least one of which is a complementary roller-couple, are positioned so that serially consecutive work portions are sequentially engaged by said roller-couples.

SEE OR SEARCH THIS CLASS, SUBCLASS:

234+, for a similar arrangement of plural roller-couples.

182 Including roller couple:

This subclass is indented under subclass 176. Subject matter wherein the deflector* includes two rollers that form a roller-couple.

183 By tension applied to work or product (e.g., uncoiling):

This subclass is indented under subclass 127. Subject matter wherein the instrumentality comprises means for applying a tensile stress to the work during deformation.

- (1) Note. This subclass includes patents disclosing the straightening of coiled metal by pulling on the free end thereof with a force sufficient to uncoil and deform the metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 205, for a disclosure wherein metal passes through a roller-couple that reduces the thickness of the metal while it is under tension.
- 274+, for a disclosure wherein metal passes through a closed-periphery die that is smaller in area than the cross-sectional area of the metal while it is under tension.

184 BY USE OF “FLYING TOOL” ENGAGING MOVING WORK:

This subclass is indented under the class definition. Subject matter including apparatus, or method employing apparatus, wherein work* moves in its entirety along a predetermined path, both to said apparatus and during deformation by said apparatus, which apparatus comprises a tool face* having two components of movement, one being toward the work into deforming engagement therewith and the other being in the direction of work movement during deformation.

- (1) Note. A roller* that rotates about an axis, which axis is fixed relative to a deforming instrumentality or is movable only towards (but not with) the moving work, is not considered to be a flying tool for this and indented subclasses. However, a roller mounted on an axis that moves with and parallel to the work surface during deformation is considered to be a flying tool, and a roller-like-tool* comprising a noncircular surface rotating about an axis is also considered to be a flying tool.
- (2) Note. The definition is intended to include a patent disclosing introduction of work into an apparatus along a predetermined compass direction and deformation of such work by a tool-face as the work and tool-face move along the opposite compass direction. Examples of such disclosure are found in subclass 189. The definition is not intended to include a patent disclosing introduction of work into an apparatus along a first direction and deformation by a tool as the work and tool move along a direction

substantially at right angles to the first direction. Examples of such disclosure are found in subclasses 343+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 343+, for disclosure of “push-drawing” and see (2) Note above.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 284+ for disclosure of a “flying tool” wherein the tool is a cutter.

185 With cutting:

This subclass is indented under subclass 184. Subject matter wherein the tool is combined with a cutter.

- (1) Note. Patents disclosing cutting means or method placed as originals in this subclass are limited to that cutting acceptable into this class (72) in accordance with Lines With Other Classes, Relationship to Combination Classes, With Cutting, of this class.

186 By composite cutting, deforming tool:

This subclass is indented under subclass 185. Subject matter wherein the deforming tool and the cutter are rigidly connected together such that movement of the tool is always accompanied by movement of the cutter, and the operation of the cutter and of the tool results from the same movement.

- (1) Note. See the search notes under subclass 464 for a listing of other subclasses providing for composite cutting, deforming tools.

187 Included in plural deforming stations or passes:

This subclass is indented under subclass 184. Subject matter including at least two groups of cooperating tool-faces*, one of which groups comprises a flying tool operating upon work moving sequentially between the tool-faces of each group.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 226+, for disclosure of plural roller-couples successively used.

188 Passes spaced along axis of rotating tool:

This subclass is indented under subclass 187. Subject matter wherein one of the tool faces of each of a plurality of such groups constitutes part of the same roller-like tool*, each tool-face being set apart from the other(s) at intervals occurring lengthwise of the axis of the tool.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

221+, for disclosure of axially spaced passes in a roller-couple.

189 Including accurately oscillating tool face:

This subclass is indented under subclass 184. Subject matter wherein the tool-face* moves in a curved path through less than 360° of movement during the deforming operation, and returns in the same curved path.

(1) Note. The return motion of the tool face may be either an idle (nondeforming) movement or a deforming movement.

(2) Note. See (2) Note under the definition of subclass 184.

190 Including orbitally moving tool-face:

This subclass is indented under subclass 184. Subject matter wherein the tool face travels in a closed loop path.

(1) Note. If a tool face travels along a path during deformation and returns along the same path during an “idle” (nondeforming) movement, the path is not a “loop” therefore a patent disclosing such an operation would be placed in another subclass within this group of subclasses.

191 Moving in circular orbit:

This subclass is indented under subclass 190. Subject matter wherein all parts of the tool's face are fixed to each other and turn about a common center, whereby the closed loop path is a circle.

192 With cooperating rectilinearly moving tool (e.g., “anvil”):

This subclass is indented under subclass 191. Subject matter whose tool-face* co-acts with a second tool having a tool-face that moves to and from in a straight line.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

207, for disclosure of a rectilinearly moving tool cooperating with a roller.

193 Comprising tool inside hollow work:

This subclass is indented under subclass 192. Subject matter wherein the second tool-face acts on the inside surface of hollow work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

208+, for disclosure of a tool inside hollow work cooperating with a roller.

194 Included in tool cluster:

This subclass is indented under subclass 191. Subject matter including a group of three or more tools disposed relative to the work and to each other such that the tools simultaneously engage the work in substantially common plane.

(1) Note. See the search note under the definition of subclass 100 for the loci of other disclosures involving use of a roller cluster or a tool cluster.

195 Circumferentially adjustable relative to work-spaced cooperating surfaces:

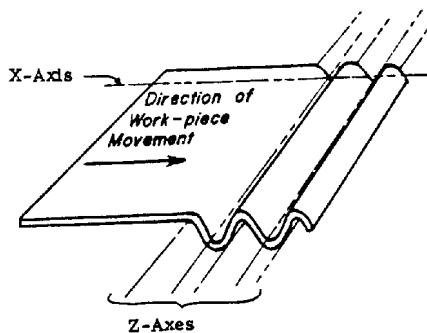
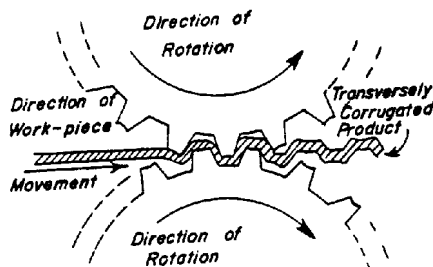
This subclass is indented under subclass 191. Subject matter whose tool face* coacts with a second rotatable tool, and wherein the tool-face of one of the tools may be repositioned about its center relative to the cooperating tool-face.

196 With cooperating complementary (e.g., conjugated) tool face:

This subclass is indented under subclass 191. Subject matter whose tool face* coacts with another tool-face, wherein one tool-face has a protuberance extending from said one tool toward the work, and the other tool-face has an indentation receding from the work into said other tool, and the protuberance of one tool

interfits (or tends to interfit) with the indentation of the other tool.

- (1) Note. Many of the patents in this subclass disclose gear-like tools that transversely corrugate work passing therebetween, see Figures accompanying this note, in which Figure 1 illustrates such structure and Figure 2 illustrates a typical transversely-corrugated product.



- 197 With cooperating roller:**
This subclass is indented under subclass 191. Subject matter whose tool-face co-acts with a roller*.
- 198 With cooperating allochiral tool-face:**
This subclass is indented under subclass 191. Subject matter whose tool-face* coacts with another tool-face, wherein the tool-faces are reversely congruent (i.e., mirror image-like) in their entirety.

199 BY USE OF ROLLER OR ROLLERLIKE TOOL ELEMENT:

This subclass is indented under the class definition. Subject matter comprising apparatus including, or method employing, a roller* tool or a roller-like tool* to deform work.

SEE OR SEARCH CLASS:

- 228, Metal Fusion Bonding, subclass 158 for rolling of metal parts combined with independent fusion bonding of the parts; and subclasses 235.2+ for simultaneous rolling and fusion bonding of the parts.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 363+ for a press forming or press reshaping means for nonmetal including an endless (e.g., roll, etc.) forming surface.

200 With modification or control of temperature of work, tool, or machine:

This subclass is indented under subclass 199. Subject matter including a step of, or means for, changing or regulating the degree of heat content of the work, the tool or any part of the deforming instrumentality wherein the tool functions.

- (1) Note. See Notes (1) and (2) under the definition of subclass 128.

201 Including cooling:

This subclass is indented under subclass 200. Subject matter wherein the degree of heat content is lowered.

202 By means (other than a tool) modifying temperature of work:

This subclass is indented under subclass 200. Subject matter wherein the changing or regulating of the degree heat content is performed by something that is not a deforming tool.

203 With cutting of work or product:

This subclass is indented under subclass 199. Subject matter wherein the tool is combined with a cutter.

- (1) Note. Patents disclosing cutting placed as originals in this subclass are limited to that cutting acceptable into this class

(72) in accordance with section VI B of this class.

204 By composite cutting-deforming tool:

This subclass is indented under subclass 203. Subject matter wherein the deforming tool and the cutter are rigidly connected together such that movement of the tool is always accompanied by movement of the cutter.

- (1) Note. See search notes under subclass 464 of this class for listing of other subclasses providing for composite cutting-deforming tools.

205 Including tautening of work during deformation (e.g., “tension bridle”):

This subclass is indented under subclass 199. Subject matter including means specifically disclosed as applying a force tending to elongate the work.

- (1) Note. To be included herein, a patent must specifically disclose that the work is placed under tension; for example, by pulling the work through a deforming station, or by retarding the movement of work to a deforming station, or by exerting force sufficient to stretch or elongate the work.
- (2) Note. Included herein are disclosures known as “bridling apparatus” or “tension bridle” means, wherein the work passes over one roll and under another roll in an undulant path similar to that found in the disclosures of subclasses 160+ and then passes to the bite of a roller couple. In this subclass, however, the metal is not stressed by such rolls acting alone; instead, the movement of the work is retarded by reason of the flexing produced thereby (and other factors), whereby that portion of the work lying between the bridle and a “downstream” roller-couple is tautened and deformed.

206 With nonroller metal-deforming station:

This subclass is indented under subclass 199. Subject matter including at least two separate deforming instrumentalities, wherein one such instrumentality does not include a “roller*”.

207 Including rectilinearly moving tool cooperating with single roller:

This subclass is indented under subclass 199. Subject matter wherein the work is deformed by a first tool-face that moves to-and-fro in a straight line, and a second tool-face that is the surface of a roller*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 192, for a similar arrangement of tools wherein the roller is replaced by a “flying tool”.

208 With tool inside hollow work:

This subclass is indented under subclass 199. Subject matter including an additional tool means that acts on an inside surface of hollow work*.

209 Comprising plug acting on longitudinally moving work:

This subclass is indented under subclass 208. Subject matter wherein the work* moves in the direction of its major dimension (i.e., extending along the longitudinal centerline of the hollow work*) and wherein the tool comprises a core that substantially fills the interior of the hollow work.

- (1) Note. Patents in this subclass disclose structure similar to that of subclass 97 except that in this subclass (208) the work does not rotate about its centerline, nor does the tool.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 97, and see (1) Note above.

210 Mounted on travelling, work-supported carriage:

This subclass is indented under subclass 199. Subject matter wherein the tool element and all the structure on which the tool is mounted are held against gravity by, and guided for movement relative to, stationery work.

- (1) Note. Included herein is a disclosure of a device that deforms a rail as it rides along that rail.

- (2) Note. The disclosure of a patent placed in this subclass clearly indicates that the deforming instrumentality is supported by the work.
- 211 Mounted on manually maneuverable carrier:**
This subclass is indented under subclass 199. Subject matter wherein the tool is supported by a tool carrier* that is adapted to be moved relative to the work by the hand of an operative.
- (1) Note. This subclass is the locus of patents disclosing a “hand-tool” used for restoring the original curvature of an automobile body or fender by manipulating the tool over dents and irregularities of the automobile.
- 212 With work forcer offset from, and relatively movable between, spaced rollers:**
This subclass is indented under subclass 199. Subject matter including a group of two rollers separated from each other, and a third tool, between which group and tool the work is placed, and provided with means for moving the roller group and/or the third tool with respect to the other toward the work and into a position wherein the third tool lies in the space separating the rollers, thus deforming the work.
- (1) Note. The axes of the rollers of the device disclosed in this and the indented subclass are either fixed with respect to each other or they are so connected that movement of one roller axis causes a corresponding movement of the other roller axis so that a plane through the roller axes at any given time is parallel to or coincident with the original plane.
- (2) Note. The patents of this subclass (212) disclose the rollers moving toward the other tool and/or toward each other on both sides of the other tool.
- 213 With use of means to move work forcer:**
This subclass is indented under subclass 212. Subject matter including driver means to effect movement of the third tool toward and into the space separating the roller tools.
- 214 Comprising tool movable relatively to stationary work portion during deformation:**
This subclass is indented under subclass 199. Subject matter whose tool moves bodily (i.e., its axis moves) to deform one part of the work while another part thereof remains immobile as disclosed.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
293+, for disclosure of work-gripping clamp and work forcer wherein the work forcer is not a roller.
- 215 Along a curved path:**
This subclass is indented under subclass 214. Subject matter wherein the movement of the tool axis follows a continuously bending line.
- 216 About a fixed pivot:**
This subclass is indented under subclass 215. Subject matter wherein the path of the axis of the tool is confined to movement in an arc having a single center of curvature.
- 217 Work between movable tool and pivot (e.g., sweep-arm bender):**
This subclass is indented under subclass 216. Subject matter wherein the center of curvature is positioned so that work to be deformed is situated intermediate the center and the tool.
- (1) Note. The devices of this subclass are commonly referred to as “sweep-arm benders”.
- 218 With means to apply torque to movable tool:**
This subclass is indented under subclass 217. Subject matter including means to turn the tool about its axis of rotation, wherein the turning force is exerted on the tool directly rather than through rolling engagement of the tool on the work.
- (1) Note. In the typical disclosure of this subclass a roller is mounted on a pivotable arm or lever, and torque is applied to the axle of the roller in addition to, or in substitution for, a force applied to the arm or lever.

219 Including adjustable tool:

This subclass is indented under subclass 217. Subject matter wherein the distance from either the tool or the work to the center of curvature (i.e., center of the arc that the tool follows) may be modified.

220 Along a straight path relative to stationary-cooperating tool:

This subclass is indented under subclass 214. Subject matter wherein the work is deformed by two coacting tools, one of which tools is immobile and serves as a support or back-up for the immobile part of the work, and the other of which tools moves in a rectilinear course during deformation.

221 Plural passes spaced along axes of one roller of tool couple:

This subclass is indented under subclass 199. Subject matter including at least two groups of cooperating tool faces, each of which groups operates upon work moving sequentially between the tool-faces of each group, wherein one of the tool-faces of a plurality of such groups constitutes part of the same roller, each tool-face being apart from the other(s) lengthwise of the axis of the roller.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

188, for disclosure of axially spaced passes in a flying-tool-couple.

222 With use of means to displace work laterally into next pass:

This subclass is indented under subclass 221. Subject matter including means for moving or guiding the work side wise of its direction of movement (i.e., parallel to the axis of said roller) after the work has been deformed by one group of tool-faces so that said work will then move between the tool-faces of a succeeding group.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

227+, for disclosure of structure wherein work is handled between successively acting plural roller-couples.

223 Roller common to two tool couples:

This subclass is indented under subclass 221. Subject matter involving use of at least three tools*, forming at least two tool-couples, wherein one of the tools is a roller* which (a) cooperates with one of the other tools to comprise one tool couple*, or (b) cooperates with another of the other tools to form another tool-couple.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

232+, for disclosure of a similar “three-high” structure having generally cylindrical rollers.

224 Included in roller cluster:

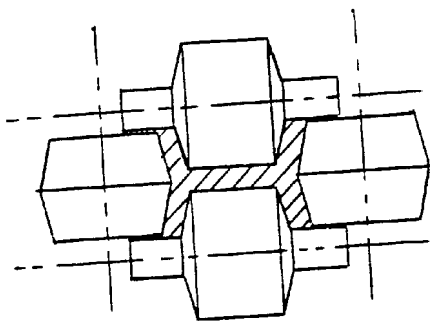
This subclass is indented under subclass 199. Subject matter including three or more cooperating rollers that form a roller-cluster*.

- (1) Note. See the search note under the definition of subclass 100 for a locus of disclosures involving use of a roller cluster or a tool cluster.

225 Comprising diverse roller pairs:

This subclass is indented under subclass 224. Subject matter wherein the rollers are arranged in groups of two, each of the two rollers of a group being alike, with the rollers of one group being different from the rollers of the other group(s); and the axes of all the rollers lie in a common plane through which the work moves.

- (1) Note. The Figure accompanying this note illustrates a typical arrangement of rollers used in the disclosures of this subclass, and also shows a cross section of the shape produced thereby.



226 Plural roller couples (e.g., successively or optionally usable):

This subclass is indented under subclass 199. Subject matter including more than one roller-couple* to deform work.

- (1) Note. Included in this subclass are disclosures wherein one roller couple is used to deform a particular workpiece and another roller couple is used, at the option of the operative, to deform the same workpiece again or to deform another workpiece. Subclasses indented hereunder, especially subclasses 234+, are the loci of disclosures wherein the same workpiece is deformed by two or more roller couples acting successively.
- (2) Note. A disclosure of a single roller couple used repeatedly on the same workpiece will not be placed in this subclass as an original patent, but will be placed on the basis of claimed structure. For example, in some disclosures such repeated use is accompanied by a “screw down” adjustment between passes, for which adjustment subclass 248 is the locus. Other such disclosures may be accompanied by work-handling means, for which means subclasses 250+ is proper.
- (3) Note. In the definitions and notes of subclasses indented hereunder, the word “material” wherever used refers only to that metal which has emerged as product from a first-acting roller couple, and is to be entered as work into a second-acting roller couple.

227 With material-handling between successive couples:

This subclass is indented under subclass 226. Subject matter wherein material is conveyed or guided from a first-acting roller couple to a second-acting roller couple.

- (1) Note. For a definition of the word “material”, see (3) Note under the definition of subclass 226.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 222, for disclosure of structure wherein work is moved side wise of its original direction between passes.
- 250+, for disclosure of material-handling to or from a tool.

228 Including optionally selectable work paths:

This subclass is indented under subclass 227. Subject matter wherein the material may be directed along one of a plurality of routes at the choice of a machine operative.

- (1) Note. For a definition of the word “material” see (3) Note under the definition of subclass 226.

229 To reverse roll the workpiece:

This subclass is indented under subclass 227. Subject matter wherein during conveying or guiding, the material retains its original compass orientation but approaches the second-acting roller couple in a direction opposite to that in which it left the first-acting roller couple, whereby the trailing edge of product becomes the leading edge of work.

- (1) Note. For a definition of the word “material”, see (3) Note under the definition of subclass 226.

230 By curved guide (e.g., “loop return”):

This subclass is indented under subclass 227. Subject matter including a passive means to limit or define the path of movement of the material to a route that is continuously bending without angles, whereby the direction of movement of the work into the second-acting roller couple is different from the direction of movement of the product of the first-acting roller couple.

- (1) Note. For a definition of the word “material”, see (3) Note under the definition of subclass 226.
- (2) Note. In the disclosures of this subclass, the successive work portions usually travel through an arc of 180° extent, such that a workpiece of indeterminate length is looped, that is, one “upstream”, work portion is moving in a first direction along a first path, while simultaneously another “downstream” work portion is moving in the opposite direction along a path parallel to the first path.
- 231 Changing orientation or direction of work:**
This subclass is indented under subclass 227. Subject matter wherein the part of the material which is first presented to the second-acting couple differs from that which was first presented to the first-acting couple, or the same portion is presented in a different manner (e.g., inverted), or any part of the path of the material between the roller couples is altered.
- (1) Note. For a definition of the word “material”, see (3) Note under the definition of subclass 226.
- 232 Including one roller, common to two roller couples (e.g., three-high mill):**
This subclass is indented under subclass 226. Subject matter wherein a particular roller cooperates with one roller to comprise one roller couple and/or cooperates with another roller to comprise another roller couple.
- (1) Note. Included in this subclass are patents generally referred to as “three-high mills”.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
223, for similar structure wherein a first-acting work-engaging area is axially spaced from a second-acting area along one of the roller.
- 233 Including roller shiftable between successive passes of work:**
This subclass is indented under subclass 232. Subject matter including means to move, or to permit movement of, said particular roller adjacent to the one roller or to the other roller to form first the one roller couple and then the other roller couple alternatively.
- (1) Note. A disclosure wherein the particular roller is shifted from one roller to the other roller at the election of the operative will fit the definition above since, regardless of the frequency or infrequency or shifting, each such shift forms first one and then another roller couple.
- 234 Including successively acting roller couples:**
This subclass is indented under subclass 226. Subject matter wherein a plurality of roller couples are positioned so that product emerges from the bite (i.e., between the rollers) of a first roller couple* and is entered as work into the bite of a second roller couple.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
227, for disclosure of structure for handling material between successive roller couples.
- 235 Comprising relatively inclined successive couples:**
This subclass is indented under subclass 234. Subject matter including a first-acting roller couple and a second-acting roller couple positioned so that, when viewed along the direction of work movement, the axes of the roller couples overlie in crossing relationship (i.e., their projections intersect on a plane perpendicular to the line of sight).
- SEE OR SEARCH THIS CLASS, SUBCLASS:
162, for disclosure of similar structure used to deflect bodily moving work.
- 236 With cleaning or conditioning of tool, or lubrication of tool or machine:**
This subclass is indented under subclass 199. Subject matter including a step of, or means for, removing foreign matter from the tool*, or preparing (e.g., by changing or maintaining the characteristics of) the tool for deformation, or for applying a friction-reducing medium to the work-engaging surface of the tool or to an instrumentality in which the tool operates.

- 237 **With carrier for roller couple or tool couple:**
This subclass is indented under subclass 199. Subject matter including means to hold the rollers* of a roller couple* or the roller-like tools* of a tool couple* in position to engage and deform work passing therebetween.
- (1) Note. A patent claiming merely a named housing for a named roller-couple, and also claiming a guide for handling work or product will be placed as an original in subclasses 250+.
 - (2) Note. For the purpose of this and indented subclasses, the term "roller cluster" should be considered as equivalent to "roller couple". Thus, a carrier for, or roller of, a roller cluster should be understood to be proper for these subclasses on the same basis as similar structures of a roller couple.
- 238 **With replacement of tool:**
This subclass is indented under subclass 237. Subject matter including structure clearly disclosed as being for the purpose of facilitating or accomplishing removal and/or introduction of one or both the tools of a tool couple.
- SEE OR SEARCH CLASS:
483, Tool Changing, subclasses 30+ for a rotary spindle machine tool combined with a tool transfer means.
- 239 **By means to replace tool:**
This subclass is indented under subclass 238. Subject matter wherein the structure performs the removal and/or introduction of a tool.
- 240 **With variation of bite of roller couple during deformation:**
This subclass is indented under subclass 237. Subject matter including a roller-couple* and means to move the axis of one of the rollers with respect to the axis of the other roller to change the spacing between the rollers while work is being deformed.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
11.8, for metal deforming by rolling, including sensing of work thickness
- and variation in roller couple spacing responsive to such sensing.
- 241.2 **Including back-up for roller:**
This subclass is indented under subclass 237. Subject matter wherein at least one of the rollers of a roller-couple is supported against movement at right angles to the axis thereof by means located between the ends of the work-engaging surfaces of the rollers in contact therewith.
- (1) Note. The roller engages the work and lies between the work and the back-up means. Pressure exerted by the work in resisting deformation is transmitted through the roller to the back-up means, rather than being wholly absorbed by the bearings of the roller.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
163, for disclosure of similar back-up means in deflecting roller structure.
- 241.4 **With means to relatively vary back-up force along roller axis:**
This subclass is indented under subclass 241.2. Subject matter wherein the roller support between the ends of the roller includes provision to vary the force transmitted to the deforming roller.
- 241.6 **Hydraulic or pneumatic force applicers spaced along roller axis:**
This subclass is indented under subclass 241.4. Subject matter wherein the provision of the back-up means to vary force transmitted thereby comprises a relatively movable cylinder and piston in which fluid or gas under pressure is placed.
- 241.8 **Means to apply bending moment to roller or back-up roll:**
This subclass is indented under subclass 241.4. Subject matter wherein the back-up is also a roller, and including means to apply to either the deforming roller or the back-up roll or a torque about an axis intersecting that roller at a right angle.
- (1) Note. The purpose of torque application herein is generally to maintain the straightness of the deforming roller,

rather than to stress the roller to which torque is applied.

242.2 Load bearing, equal size pair of back-up rolls:

This subclass is indented under subclass 241.2. Subject matter wherein the back-up comprises first and second rollers of approximately the same diameter, positioned such that their axes are parallel to each other and to the axis of the deforming roller and such that they are close to, but not touching each other, so that the supported deforming roller fits between them and they receive equal shares of the reactive force of the deforming load.

242.4 And second stage, equal size pair of back-up rolls:

This subclass is indented under subclass 242.2. Subject matter wherein at least one of the back-up rollers is in turn supported by first and second rollers of approximately the same diameter (which may be different from the diameter of the primary back-up rolls) positioned such that their axes are parallel to each other and to the axis of the deforming roller and such that they are close to but not touching each other, such that the supported back-up roll fits between them and they receive equal shares of the force of the supported back-up roll.

- (1) Note. One of the second stage back-up rolls may also serve to receive force from a second back-up roll.

243.2 Including reaction roll:

This subclass is indented under subclass 241.2. Subject matter wherein the deforming roller supporting means includes a roller for engaging the deforming roller and preventing the deforming roller from moving in a direction normal to the roller axis and parallel to the surface of the workpiece being deformed thereby.

243.4 Equal size pair of reaction rolls:

This subclass is indented under subclass 243.2. Subject matter including a first roller for engaging the deforming roller to prevent the roller from moving forwardly and a second roller for engaging the deforming roller to prevent the roller from moving rearwardly, wherein the first and second rollers are approximately equal in diameter.

243.6 Irregular, convex, or hollow back-up roll:

This subclass is indented under subclass 241.2. Subject matter wherein the back-up comprises a roller wherein (1) the work engaging surface is of distinct, different diameters along its length, (2) the work engaging surface is of a first diameter at its axial center and gradually tapers to lesser diameters at its axial work engaging extents, or (3) wherein the interior thereof is void.

244 With interposer (e.g., wedge or gag) between tool and pressure applier:

This subclass is indented under subclass 237. Subject matter including means urging the tools of a tool couple toward each other, wherein said means includes an element lying intermediate a portion on the axis of a rotating tool and a portion of the tool urging means, which element moves parallel to the tool axis or parallel to the direction of work movement to reposition one roller relative to the other.

- (1) Note. This definition is intended to exclude a "screw down" adjustment, per se, for which "screw down" subclass 248 is provided.
- (2) Note. The structure described permits a quick or a fine adjustment of the spacing between rollers.

245 Including fluent-driven tool support:

This subclass is indented under subclass 237. Subject matter including means to reposition one of the tools of a tool couple with respect to the other, wherein said repositioning means is moved by a fluid motor.

246 Including resiliently urged tool support:

This subclass is indented under subclass 237. Subject matter including means to reposition one of the tools of a tool couple with respect to the other, wherein said repositioning means is elastically biased.

247 Including means to position tool along axis:

This subclass is indented under subclass 237. Subject matter including means to reposition one of the tools of a tool couple with respect to the other by moving it lengthwise of its axis of rotation.

248 With “screw down” to adjust bite of tool couple:

This subclass is indented under subclass 237. Subject matter including means to reposition one of the tools of a tool couple with respect to the other, wherein the axes of rotation of the tools lie in substantially the same plane, and the means includes a threaded member rotatable about a line substantially perpendicular to the axis of at least one tool and lying in, or parallel to, said plane.

249 With means to drive tool:

This subclass is indented under subclass 237. Subject matter which, as claimed, includes means to apply driving force (i.e., torque) to the roller(s) tending to turn the roller(s) about the axis (or axes) thereof.

250 With handling of, or guiding of work or product relative to tool:

This subclass is indented under subclass 199. Subject matter including structure to move or position either (a) work to be presented to a tool couple* or (b) the product of a tool couple.

- (1) Note. Included in this subclass is disclosure of means for moving the same work repeatedly through the zone of operation of a tool couple.

SEE OR SEARCH THIS CLASS, SUBCLASS:

227+, for disclosure of work-handling between successive tool couples.

251 By endless belt or conveyor roll:

This subclass is indented under subclass 250. Subject matter wherein the work-handling means includes a material-engaging surface that is on, or part of, either an integral or concatenated band which band moves in a closed loop about a plurality of separated, noncoaxial pulleys or sprockets, or wherein the work-handling means includes a work-engaging element of a configuration similar to that of a roller*, which element does not deform the work.

252 By reciprocating or oscillating means:

This subclass is indented under subclass 250. Subject matter wherein the work-handling means moves to-and-fro along a single path, at least one of which movements occurs during

handling of the work to cause a corresponding movement of work.

- (1) Note. Disclosures in this subclass are not limited to means for moving work directly into the bite of a roller couple, but also include means for lifting and/or lowering the work laterally of the direction of movement into the roller couple.

252.5 Roller or roller-like tool-element of particular configuration:

This subclass is indented under subclass 199. Subject matter wherein the tool-element is of a specified or irregular physical shape.

253.1 BY EXTRUDING THROUGH ORIFICE:

This subclass is indented under the class definition. Subject matter comprising means for, or a step of using means for, squeezing metal by applied pressure through and out of a continuous periphery shape-imparting orifice* in an otherwise closed chamber (generally called a “container”), or past the most constricted section of a constricted passageway* leading from the otherwise closed chamber.

- (1) Note. See Lines With Other Classes, Relationship to Combination Classes, With Assembling, of this class regarding assembly. The present subject matter is, as there pointed out, an exception to the general rule that assembly is excluded from this class. For instance, sheathing a cable by extruding metal around it is classified here, as in subclass 268.

- (2) Note. Extruding through an orifice, as here defined, is also known as “die expressing” or “spurting”.

- (3) Note. Extrusion is one of the “closed die” operations (i.e., those employing a closed perimeter shape-imparting orifice, passageway, or closed cavity into and/or through which work is forced). Wire-drawing through a closed die is found in subclasses 274+. Residual closed die combinations such as “push-drawing”, “shell-drawing”, and “closed die forging” are in subclasses 343+.

- (4) Note. Tool structures which are unique to extruding are classified in this and

indented subclasses, e.g., bridge-mandrel-die means in subclass 269, containers in subclass 272, and rams in subclass 273. On the other hand, dies and mandrels, which by their nature are considered to be usable otherwise in metal deforming practice, are found with the residual tools in subclasses 462+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 54+, for extrusion in which a fluent medium serves as the pressure tool means.
- 274+, and 343+, for operations other than extruding for forcing metal through an orifice or into a passageway.
- 467+, for an extrusion die, per se.

SEE OR SEARCH CLASS:

- 65, Glass Manufacturing, subclass 183 for apparatus to shape molten glass by extruding.
- 99, Foods and Beverages: Apparatus, subclass 450.1 for apparatus for edible laminated product making, including an extrusion former and downstream laminating means.
- 100, Presses, for a press structure of general utility which is not provided for here or in some other class.
- 156, Adhesive Bonding and Miscellaneous Chemical Manufacture, subclass 47 for a residual method of making (including sheathing) an electrical conductor of indefinite length; and subclasses 244.11+ for a process of extruding combined with laminating downstream of the shaping zone.
- 164, Metal Founding, subclasses 451+ and 459+ processes of continuously casting metal; and subclasses 418+ for corresponding apparatus.
- 219, Electric Heating, subclasses 50+ and 602+ for electric heating of metal combined with its working.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 176.1+ for a process of extruding non-metallic plastic material not otherwise provided for.
- 419, Powder Metallurgy Processes, especially subclass 41 for processes of forming articles from particulate

material including metal particles, including forming a body of powder before sintering by extrusion followed by a heating step of effect sintering; and subclass 67 for similar processes where heat is not applied after the extrusion step.

254

With cutting:

This subclass is indented under subclass 253.1. Method or means including a step of, or means for cutting* which is not excluded by Lines With Other Classes, Relationship to Combination Classes, With Cutting, of this class.

- (1) Note. Splitting a workstream on a bridge mandrel or a multiapertured extrusion die is considered to be part of the extrusion process and not cutting, and is found in disclosures of subclasses below, particularly subclasses 261 and 269.
- (2) Note. If it is evident that a slug is punched out during a piercing operation the patent is placed here.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 256, for extrusion combined with billet piercing by plastic deformation and without removal of material, when the piercing occurs as a distinct and separate metal deforming operation.
- 264+, for extrusion combined with billet piercing by plastic deformation and without removal of material when the piercing occurs as a distinct and separate metal deforming operation and when the piercing is accomplished by a mandrel as a part of or in connection with extrusion.
- 324+, for other types of metal deformation combined with cutting.

SEE OR SEARCH CLASS:

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclass 308 for extrusion apparatus for non-metals combined with means to sever the product.

255 Severing product from stock or residue:

This subclass is indented under subclass 254. Method or means including a step of, or means for, cutting which detaches a product of extrusion from a remaining coherent parent body of material left behind the said product by the extrusion operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

324+, and particularly subclasses 331, 334, and 338, for severing a product of another type of MD from stock or residue.

256 With metal-deforming other than by extrusion:

This subclass is indented under subclass 253.1. Method or means for effecting a metal-deforming operation of a type other than and in addition to an extrusion operation.

(1) Note. Forging to a particular shape, whether intentional or not, as the result of incomplete extrusion, is considered to be part of the extrusion process and not another metal-deforming operation. Leaving unexpressed in the extrusion chamber a compacted residue having the shape of the occupied portion of the chamber (even when for the purpose of heading or bottoming extrusion product, for instance) is not a separate forging operation, and consequently is not considered proper subject matter for this subclass.

(2) Note. Search this class, any appropriate area above, e.g., subclasses 68, 130, or 206, for the metal shaping operation provided for there, combined with extrusion.

SEE OR SEARCH THIS CLASS, SUBCLASS:

254+, for billet piercing accomplished or accompanied by cutting, as by punching out a slug.

264+, for billet piercing accomplished by an extrusion mandrel as part of or in connection with extrusion.

257 With product handling:

This subclass is indented under subclass 253.1. Method or means which comprehends stripping, ejecting, or otherwise transporting or receiving the die-formed product of the extrusion operation (not the stump or other residue) from the deforming apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

361, for product handling associated with another type of closed die apparatus.

419+, for another type of metal-deforming apparatus combined with means to handle work or product, and see the notes thereunder for handling devices, per se.

258 Expressing polymetallic-layered product:

This subclass is indented under subclass 253.1. Method or means for producing solely by the process of extrusion of an article or material consisting of layers composed of different elemental metals or alloys.

SEE OR SEARCH THIS CLASS, SUBCLASS:

47, for coating of metal followed by metal deformation.

259 By plural impellers operating into one extrusion chamber:

This subclass is indented under subclass 253.1. Method or means in which the squeezing means comprises a plurality of distinct force applying instrumentalities, (e.g., plungers) working cooperatively into a common work confining chamber for extrusion of material therefrom.

260 Expressing nonuniform cross section or nonlinear product:

This subclass is indented under subclass 253.1. Methods and means for extruding a product which (a) varies longitudinally, with respect to its flow through the orifice, in cross-sectional size, shape, or axial orientation (without regard to a closed bottom on an otherwise tubular extruded article or a shaped head remaining as a residue in the chamber), or (b) is curved in its longitudinal extent, that is, the produce deviates from straight.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 64+, for twisting preformed axially moving work.
- 259, for a plural impeller device for extruding this type of product.

261 **Expressing plural products:**

This subclass is indented under subclass 253.1. Methods and means utilizing or including (a) a plurality of coupled machines each capable of independently extruding at least one formed product, or (b) a single machine which is adapted to produce mutually distinct extruded products from a common work-confining chamber simultaneously through a multiorificed die.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 262, and 268, for production of a multicored extrusion, e.g., a plurality of separate wires embodied within a single lead sheath.
- 468, for a multiorifice die arrangement, per se.

262 **By rotating impeller means:**

This subclass is indented under subclass 253.1. Method or means wherein the work is forced toward an extrusion orifice by means which comprises work-contacting spirally (e.g., helically) arranged ribs and/or grooves, rotatable relative to the container wall about the spiral's axis, or by an equivalent rotatably progressive surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 467+, for a die, per se.

263 **Nonaxial movement of die, ram, mandrel, or container:**

This subclass is indented under subclass 235.1. Method or means in which any one of an orifice-containing die*, a pressure-applying plunger, an internal-forming means (as defined in subclass 264), or a container, is movable in a transverse direction (relative to normal material flow), with regard to its static operative position or to its operative movement during normal material flow.

- (1) Note. The side movement may be for any operative purposed, e.g., charging or loading the apparatus, stripping or ejecting the product, or assembling, adjusting, or lining up parts of the apparatus, such as the die and/or container. See the search note below.

- (2) Note. The mere closing of split dies is not included; in the concept of nonaxial movement, the entire die assembly must be laterally movable. Also, mere rotation about a central axis is not included; however, eccentric rotation having a side wise component is.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 257, for a method or means including stripping or otherwise handling, a product, where such is positively claimed; this operation may frequently include use of a laterally movable element as here indicated.

264 **Utilizing internal-forming means (e.g., mandrel) or core tube (e.g., wire guide):**

This subclass is indented under subclass 253.1. Method or means utilizing or including a member which projects axially into or adjacent to, but in either case is spaced from the wall of, the extrusion orifice or passageway and cooperates therewith to provide a cored annular orifice through which a generally tubular product may be extruded, the interior configuration of the product corresponding to the outer configuration of the member.

- (1) Note. The member is generally known in the extrusion art as a "mandrel". If it constitutes a tubular core guide means, as defined under subclass 268 below, it is generally called a "core tube".

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 462+, for a mandrel structure, per se.

265 **Movable longitudinally in ram:**

This subclass is indented under subclass 264. Method or means utilizing or including apparatus in which a plunger constitutes pressure-applying means and the internal-forming

means is a mandrel, and both the plunger and mandrel point in the direction of the extrusion flow and in line therewith, the mandrel being slidable within and relative to the plunger during some portion of the operational cycle of the machine.

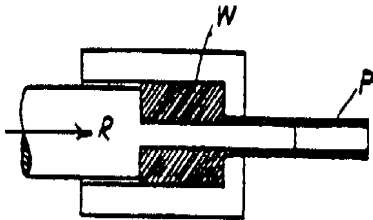
SEE OR SEARCH THIS CLASS, SUB-CLASS:

266, for a mandrel which is merely longitudinally adjustable in the plunger, the relation between the two being otherwise fixed during operation.

266 **Integral with ram:**

This subclass is indented under subclass 264. Method or means in which a plunger constitutes pressure-applying means and is integrally formed with or rigidly joined to the internal-forming means for simultaneous operational movement therewith.

- (1) Note. Patents involving longitudinal adjustment between the plunger and mandrel where the relation between the two is fixed during operation are included.



Extrusion by ram with internal mandrel (subclass 266).

267 **Single element ("impact extrusion" type):**

This subclass is indented under subclass 266. Method or means wherein the extrusion chamber comprises a cavity in a cuplike member, into which cavity a deforming element constituting a combined plunger and internal-forming means is movable, the cavitated member being closed to work material flow except for an annular orifice formed between the cavity wall and the element periphery when in operative position so that upon movement of said

element further into said cavity the work flows backward around the element as a tubular product corresponding in shape to the internal configuration of the cavitated member and the external configuration of the element.

- (1) Note. The element (usually a plunger), the chamber means, the bottom, per se, of the chamber means, or any combination of these parts may move to perform the pressing operation.
- (2) Note. The operation here performed is known by several names, among which are: Impact extrusion, Backward extrusion, and Cold Squirting.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

257, for a device of this type in combination with a stripper or ejector.
362+, for forging into a closed die which may result in backward flow but without extrusion.

268 **Core tube:**

This subclass is indented under subclass 264. Method or means in which the member is a tubular guide means, other than the extrusion orifice or passageway, which extends from outside the closed chamber means into the chamber at a point remote from the orifice and then from the chamber axially into or adjacent the orifice or passageway and is adapted to allow an elongated core means, such as a wire, to be passed therethrough, around which a sheath like extruded product may be formed.

- (1) Note. An extrusion device including a core tube is found in many of the subclasses above indented under subclass 253.1, and see also subclass 270 below for a disclosure of the same when the claimed invention lies in a work supply feature.

SEE OR SEARCH CLASS:

156, Adhesive Bonding and Miscellaneous Chemical Manufacture, subclass 51 for extruding a nonmetallic sheath around an electric conductor of indeterminate length.

269 Bridge mandrel:

This subclass is indented under subclass 264. Method or means in which the member is a mandrel which is supported by bridge pieces extending from the mandrel across the rear (i.e., the chamber end) of the orifice or passageway.

- (1) Note. The bridges split the work stream, which is then reunited autogenously by pressure prior to extrusion through the orifice.
- (2) Note. This subclass includes a bridge mandrel die unit, per se.

270 Work supplying:

This subclass is indented under subclass 253.1. Method or means which utilizes or includes means for storing work material and/or feeding or transporting work material to the deformation chamber.

- (1) Note. This subclass includes "charging" an extrusion container by pouring in molten metal which autogenously welds to an earlier residue and then solidifies in situ.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 262, for a rotatable impeller extruder with work supply.
- 263, for side wise movement of a specified portion of the apparatus, which movement may be for the purpose of permitting or facilitating charging.
- 419+, as well as appropriate other subclasses under the several types of metal deformation in this class or other work handling.

SEE OR SEARCH CLASS:

- 193, Conveyors, Chutes, Skids, Guides, and Ways, for conveyors, per se.
- 198, Conveyors: Power-Driven, for conveyors, per se.
- 221, Article Dispensing, for an article dispenser, per se.
- 414, Material or Article Handling, in particular subclasses 754+ where billet turnover devices can be found and compare with those devices in Class

198, Conveyors: Power-Driven, subclasses 373+.

271 Pressure or velocity conditioning:

This subclass is indented under subclass 253.1. Method or means wherein the extrusion through the orifice occurs under a particular absolute or relative pressure or velocity of, or for the apparatus, the work or the product during deformational operation.

272 Container and/or support therefor:

This subclass is indented under subclass 253.1. Apparatus comprising closed chamber means, or cover or closure means therefor, or structure for supporting or axially moving the closed chamber means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 263, for the same plus a nonaxial component of container movement.

SEE OR SEARCH CLASS:

- 220, Receptacles, appropriate subclasses for a receptacle not specially adapted to use in extrusion apparatus.

273 Ram or ram element:

This subclass is indented under subclass 253.1. Apparatus comprising a reciprocable plunger or equivalent structure for applying extrusion pressure directly on work located and confined within the container, or a detail or element of such structure (e.g., a dummy block).

- (1) Note. Because of the peculiar nature of extrusion, extrusion rams, and elements thereof are classified here. For metal-deforming tools generally, including plunger means otherwise usable, see subclasses 462+.

SEE OR SEARCH CLASS:

- 100, Presses, subclasses 214+ for a reciprocating press construction; and subclasses 295+ as the residual locus for pressure surface elements.

273.5 Indirect extrusions:

This subclass is indented under subclass 253.1. Subject matter in which the orifice or constricted passageway is formed through a member which, during and for the squeezing

operation, extends within the container and is telescopically movable relative thereto.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

264+, for a member provided with an extrusion orifice or restricted passageway and another member, generally a mandrel (or a core tube in indented subclasses 268) spaced from the wall of the first member to cooperate therewith to define an annular space through which tubular (generally) product may be extruded; and in which member may be telescopically movable within the container.

274 BY PULLING WORKPIECE THROUGH CLOSED PERIPHERY DIE (E.G., ROD-, TUBE-, OR WIRE-DRAWING):

This subclass is indented under the class definition. Subject matter comprising means including, or a step of using means including, an orifice* and/or passageway*, through which work is drawn by the application of external tensile force.

- (1) Note. Apparatus of this subclass, and the indented subclasses, is usually intended to operate upon work having an initial dimension that is only slightly larger than the opening in the closed die to reduce the cross-sectional area of the work, with or without altering the basic cross-sectional shape thereof.
- (2) Note. In regard to the underlined portions of (1) Note, immediately above, note that subclasses 127+ provides for alteration of cross-sectional shape of travelling work (e.g., troughing subclasses 176+) which may also be accomplished by pulling through a closed die.
- (3) Note. For the purpose of patent placement in subclass 274, and the subclasses indented thereunder, a work gripping and/or moving means will be treated in accordance with the criteria set forth in (1) Note under the definition of subclass 276.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 64, for subject matter in the “twisting” area which may also utilize a closed periphery die.
- 127, for “skelping”, or longitudinally troughing, a bodily moving workpiece by using a closed periphery die without reducing the cross-sectional area of the strip or “skelp”.
- 293, for metal deformation by a stationary nondeforming work-gripping claim and movable closed periphery die.
- 343+, for metal deformation by a closed die(s) moved along a stationary workpiece, and/or for push-drawing, i.e., altering the cross-sectional area of a rod or tube by pushing it through a closed die.

275 With cutting:

This subclass is indented under subclass 274. Subject matter comprising a step of, or means for cutting which meets the requirements stated in the class definition. (See Lines With Other Classes, Relationship to Combination Classes, With Cutting, of this section).

- (1) Note. For inclusion in this class, the cutter in every instance must be associated with metal-deforming apparatus, and must cut (sever, incise, punch, shape, grind, etc.) material which is the subject of the metal-deforming operations performed by the associated apparatus.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

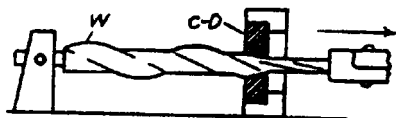
- 324+, for the combination of cutting and metal-deforming means associated with conventional apparatus or operations (e.g., punch press, bending, etc.).

276 Producing a nonuniform product:

This subclass is indented under subclass 274. Subject matter which functions to form a relatively rigid elongated product* having at least one of the following characteristics: (a) the central longitudinal axis of the product does not constitute a straight line; or (b) at two spaced points along the central longitudinal axis, the transverse cross sections of the prod-

uct (whether solid or hollow) are not identical in one of the following respects: (i) size, (ii) shape, (iii) wall thickness, or (iv) orientation about the centerline.

- (1) Note. Many products are either (a) intentionally left "pitted", "scored", etc., for purposes such as esthetics effect or lubrication, or (b) intentionally, or unintentionally, partially deformed (usually at the leading end) when they are gripped, pulled, or otherwise handled. If such deformations are claimed, then placement herein is proper, even though such deformation will later become "waste" if placement is otherwise appropriate for subclasses 274+. If, however, such deformation is unintentional, and/or disclosed but not claimed, then such patents will be found in subclasses further indented under subclass 274.
- (2) Note. In the figures below, the tubular workpiece illustrates items (ii), (iii), and (iv) under part (B) of the definition of this subclass.



Drawing a nonuniform product, (e.g., from pre-twisted eccentric tubing) (subclass 276)

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 59, for a method of or means for corrugating tubular work utilizing fluent material as a "tool".
- 136, for deflecting to form a helical coil or tube including the thinning of a portion of the work.
- 240, for varying the bite of a roller couple during deformation.
- 260, for method or means for forming a non-uniform product by extruding.

318, for die-forging the end of indeterminate length work.

277 **With movement of discrete workpiece angularly, laterally, or in a reverse direction:**

This subclass is indented under subclass 274. Subject matter including active means operative either before or after the work* has engaged the closed die element to direct said work (a) back through the same closed die, (b) to a second closed die, or, (c) to a metal-deforming tool that is not a closed die.

- (1) Note. The notes under the definition of subclass 419 contain a comprehensive listing of search areas related to work and/or product handling.

278 **Utilizing plural metal-deforming tools:**

This subclass is indented under subclass 274. Subject matter comprising two or more metal-deforming instrumentalities, or the steps of using the same.

- (1) Note. The second or subsequent metal-deforming tool may, or may not, be of the type peculiar to subclass 274.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 33+, 592+, 650, and 700+ for method or apparatus appropriate to Class 29, which may include tension drawing as one of the steps or means in an assembling or similar operation.
- 83, Cutting, subclass 120, 213+, 255+, 301+, 357, 404+, 549+, 598+, and 618+ for a cutting device having plural cutting stations.

279 **Varying speed or continuous workpiece through successive tool stations:**

This subclass is indented under subclass 278. Subject matter which functions to move one portion of a workpiece through one of the instrumentalities at a speed which is different from that at which another portion is moved through another of the instrumentalities.

- (1) Note. Typical patents in this subclass include wire-drawing disclosures which provide for successively smaller closed dies, with rotating drums therebetween, and drive means to pull the wire (by

rotating the successive drums) at increasing speeds as the wire is reduced and elongated at each smaller closed die.

SEE OR SEARCH THIS CLASS, SUBCLASS:

288, and 289, for a metal-deforming device having a single drum driven at a varying or uniform speed, respectively.

280 Accumulating work between successive tool stations:

This subclass is indented under subclass 278. Subject matter including means providing slack in moving work, or temporarily storing work, after it has passed one instrumentality and before it is deformed by an additional instrumentality.

SEE OR SEARCH THIS CLASS, SUBCLASS:

288, and 289, for a metal-deforming device having a single drum driven at a varying or uniform speed, respectively.

281 Including noncoaxial closed dies:

This subclass is indented under subclass 278. Subject matter wherein the longitudinal axis of the orifice or passageway of one die is other than a straight-line continuation of the longitudinal axis of at least one other orifice or passageway.

- (1) Note. The provision of one closed die that is pivotally mounted with respect to a second closed die is sufficient for placement in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

277, for a metal-deforming device which may include closed dies.

285, for a metal-deforming device having a single closed die that may be pivoted with respect to other elements of the metal-deforming device.

282 All closed dies coaxially aligned:

This subclass is indented under subclass 278. Subject matter wherein a line forming the longitudinal axis through one orifice or passageway is coincident with the line forming the longitudinal axis through each and every other claimed orifice or passageway.

283 Including a mandrel inserted within a hollow workpiece:

This subclass is indented under subclass 278. Subject matter including an internal die (male die, punch, push-rod, etc.) which is positioned inside a generally-tubular workpiece, at least a portion of said internal die entering a portion of the orifice or passageway, so that said internal die determines at least some internal dimension of the tubular workpiece.

SEE OR SEARCH THIS CLASS, SUBCLASS:

253.1+, and 343+, for a combination including die and mandrel units in the extruding and in the residual closed die operations, respectively.

284 And applying a "pushing" force:

This subclass is indented under subclass 274. Subject matter which functions to assist the "drawing" of the work by propelling the work, or the die, relative to the pulling means.

- (1) Note. The additional means of this subclass may (a) "push" the work into the closed die, or (b) move the closed die over the work (both of these operations being frequently described in the art as "threading" the die) before, during, or after the action of the pulling means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

343+, and 418, for a metal-deforming device which may include means to "push" work toward a closed die, or a cooperating tool, respectively.

285 Movable die:

This subclass is indented under subclass 274. Subject matter including means to move or permit movement of the die with respect to a fixed point.

- (1) Note. The active or permissive movement of the closed die may occur continuously or intermittently during the drawing of the workpiece.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 281, for a metal-deforming device including plural closed dies, one of which may be movable, and see (1) Note thereunder.
 293, for combination including nondeforming work gripper and a relatively movable die.
- 286 With heating or cooling:**
 This subclass is indented under subclass 274. Subject matter including means which, directly or indirectly, raise or lower the temperature of all or part of the work.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 342.1+, for heating or cooling of other metal-deforming devices, and see the search notes under that subclasses (342.1+).
- 287 Utilizing specific work-moving means:**
 This subclass is indented under subclass 274. Subject matter including a definitely described seizing and tensioning means which is effective to draw work through the die.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 419+, and the search notes thereunder, for work or product handling means in a metal-deforming device.
- SEE OR SEARCH CLASS:
 226, Advancing Material of Indeterminate Length, in general, for work-handling or product-handling method or apparatus.
 414, Material or Article Handling, subclasses 14+ for stock pulling and/or pushing devices, and see the search notes thereunder.
- 288 Varying speed of moving work:**
 This subclass is indented under subclass 287. Subject matter including means operative to increase or decrease the rate of movement of the workpiece, at will or cyclically, during drawing.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 425, for a metal-deforming device including means to vary the speed of either work or product.
- 289 Rotating a drum, roll, sheave, etc.:**
 This subclass is indented under subclass 287. Subject matter including a driven rotating element which engages the workpiece and moves it by winding it around the rotating element.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 278+, for plural metal-deforming tools, one of which may include a drum die combination.
- 290 Interrelated work gripper and carrier:**
 This subclass is indented under subclass 287. Subject matter including a movable member which supports either or both the work and a gripper (a nondeforming work-gripping clamp), and including additional means which interconnects and may move said movable member and said work or said gripper.
- (1) Note. Engagement of the gripper(s) with the work may start the additional means, movement of the carrier may cause the gripper to engage or disengage the work, cessation of movement of the carrier may cause the gripper to engage or disengage the work, or any combination of the above may characterize the device.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
 422, for a combination that does not claim the gripper and moving means in combination with a closed periphery die.
- 291 Maintaining a "straight-line draw":**
 This subclass is indented under subclass 287. Subject matter including structure which prevents the work seizing and tensioning means, or the work itself, from canting, rotating, tilting, or otherwise moving out of the desired path of movement.
- (1) Note. The above described structure may be positioned on either side, or both

sides, of a die; and, it may restrain the path of movement of the work, the gripper, the carrier, the elements of the motive means, or any combination of the above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

428, for work-handling means including a work guide in combination with conventional apparatus (e.g., a metal-deforming press).

SEE OR SEARCH CLASS:

269, Work Holders, subclass 35 and 256 for a workholder having interrelated parts which are restricted to "straight-line" movements.

292 BY TIGHTENING FLEXIBLE BAND OR CHAIN ABOUT WORK:

This subclass is indented under the class definition. Subject matter comprising means, or a method of using means, which includes a cable, a strap, or series of articulated links which engages and surrounds the major portion of the so-engaged periphery of work and, when placed under tension, applies deforming force to the work.

- (1) Note. For placement in this subclass, the band or chain must encircle more than half the periphery of the workpiece (the remainder may be engaged by a fixed die or support); if the flexible tool means engages less than half the periphery of the work, it is regarded as a "yieldable-face" tool, for subclasses 396+, such tools requiring an opposed face coacting tool to effect compression or crushing of work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

54+, for a compression of work by surrounding fluent medium.
 396+, for a tool having a flexible or yieldable face portion opposed by another tool, and see (1) Note above.
 402, for a plurality of tools concurrently movable radially inwardly against work.
 465.1+, for a flexible or yieldable tool, per se.

SEE OR SEARCH CLASS:

100, Presses, subclasses 1+ for process or apparatus for tautening a binder about material to compress it.

293 BY USE OF NONDEFORMING WORK-GRIPPING CLAIM AND RELATIVELY MOVABLE CLAMP, TOOL OR WORK FORCER:

This subclass is indented under the class definition. Subject matter comprising means, or the step of using means, which includes a plurality of coacting distinct work-engaging instrumentalities, and means to move or guide at least one such instrumentality with respect to another such instrumentality along a predetermined path; one of said instrumentalities having a plurality of opposed solid jaws or surface elements which are made effective, by movement of one or more of said jaws or surface elements, to grip a portion of work fictionally and to hold it securely during an operation of the class type.

- (1) Note. The work-gripping clamp in subclasses 293+ may be an ordinary clamp; some form of actuating means is required to distinguish a clamp from a mere work-stop or work-supporting socket. Self-gripping clamps are included, (i.e., those which close in response to slight and initial movement of the work).
- (2) Note. For placement in subclasses 293+, it must be clear that at least one work clamp has solely a clamping function (i.e., any disclosure of work deformation by closure of the clamp jaws, or of work slippage with respect to the jaws, or of work slippage with respect to the jaws during deformation, indicates that the "clamp" actually constitutes a tool couple or a tool element for original placement elsewhere in this schedule). A nondeforming (per se) clamp may, however, be provided with deforming or die surface elements or portions distinct from the clamp jaws proper, such arrangements being found in subclasses 320+ and 322+ indented hereunder. For placement in subclasses 293+, the clamp must be claimed, but it need not be

recited as a deforming instrumentality (e.g., it may have an auxiliary function as a steadying element). If deformation is effected by relative motion between two or more clamps, placement is in subclasses 295+; If a clamp moves work relative to a tool, placement is in subclasses 308+; if the clamp holds work against the force of an actuated tool, placement is in subclasses 316+.

- (3) Note. For placement of a process patent in subclasses 293+, the claim should recite “clamping” of work or an equivalent expression (such as “holding”, if based upon a disclosure of clamping or refer to clamped, etc., work in addition to reciting the operative deforming step.
- (4) Note. A work gripper or clamp may be found in many combinations placed in preceding subclasses, e.g., subclasses 274+ (wire-, rod-, or tube-drawing). These subclasses (293+) are the residual loci for a metal-deforming combination comprising, per se, nondeforming work clamp or gripping work mover. Any work clamp or gripper found in claimed combinations below subclasses 293+ is not solely a clamp but has another function, such as crushing or otherwise directly deforming work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 80+, for a rotatable work-holding form which may comprise clamp structure.
- 127+, for a work gripper used to pull work through deflecting apparatus.
- 274+, for a work gripper used to pull work through a closed die.
- 350+, for a blank holder in deep-drawing apparatus (which generally allows controlled slippage of work).
- 419+, for a work or product handling device, generally.
- 457+, for a work constrainer in metal-deforming apparatus.
- 459, and 460, for a work clamp without a co-acting metal-deforming tool.

SEE OR SEARCH CLASS:

- 269, Work Holders, appropriate subclasses for a work holder of clamping type; and subclasses 87+ for the combination with a tool couple element (such as a tool guide).

294

With cutting:

This subclass is indented under subclass 293. Subject matter comprising a step of, or means for, a systematic cutting* of the material which is the subject of metal deformation.

- (1) Note. See Lines With Other Classes, Relationship to Combination Classes, With Cutting, of this class for the relationship between Class 72 and other classes involving cutting for a statement of the subject matter included in this class, and for examples of included and excluded combinations.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 40, for mechanical cleaning or descaling which may involve cutting (e.g., grindings, scrapping, machining).
- 324+, for cutting associated with residual metal-deforming operation or apparatus, and see the notes thereto for references to all pertinent cutting subclasses in the Class 72 schedule.

295

By individually nondeforming clamps:

This subclass is indented under subclass 293. Subject matter wherein at least two of said relatively movable work-engaging instrumentalities each have a plurality of opposed solid jaws or surface elements which are made effective, by movement of one or more of said jaws or surface elements, to grip a portion of work frictionally and to hold it securely.

- (1) Note. The function of each individual clamp is to immobilize a portion of work; their relative motion, however, induces internal stresses of deforming magnitude in intervening portions of work, to effect bending, twisting, stretching, etc. The relatively movable clamps are thus equivalent to a tool couple. Such tool couples, because of their unique effect, are collected in this sub-

class area, ahead of “clamp and tool” and “clamp and work forcer” combinations.

- (2) Note. The combination of individually nondeforming, relatively movable work clamps and a tool of more conventional type (i.e., which deform work at its point of contact therewith) is found below in subclasses 296+; the usual operation of such a combination is “stretch forming” (see also subclass 305).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 305, for plural relatively stationary work clamps and a relatively movable tool.
308, for a work clamp employed as an active tool (i.e., as a work forcer).

296 With co-acting relatively movable tool:

This subclass is indented under subclass 295. Subject matter comprising a third instrumentality or the use of an instrumentality designed and intended to engage work with deforming force, and means effective to change the location of said third instrumentality with respect to two or more of said work-gripping instrumentalities, during an operation of the class type.

- (1) Note. The third instrumentality may consist of a more conventional tool, e.g., a die or forming block against which work is drawn or wrapped while being maintained under tension by the clamps. Many such stretch-forming devices are included in this subclass.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 305, for spaced (e.g., fixed) clamps and relatively movable tool.
309, for a movable work clamp and coacting, relatively movable tool.
323, for a work clamp and plural coacting tools.

SEE OR SEARCH CLASS:

- 269, Work Holders, subclasses 87+, for a work clamp combined with a tool couple element (such as a tool guide).

297 With means to actuate tool:

This subclass is indented under subclass 296. Subject matter utilizing a power-transmitting element effective to drive said further instrumentality during an operation of the class type.

- (1) Note. When the coacting tool is an actuated member, as in this subclass, the work-gripping clamps may be either driven or passive members, but in any case they must be capable of relative motion with respect to each other (e.g., they may be independently pivotally mounted).

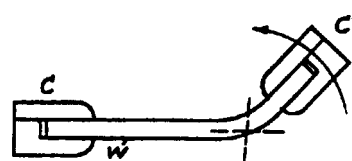
SEE OR SEARCH THIS CLASS, SUBCLASS:

- 305, for spaced (e.g., fixed) work clamps and relatively movable tool.

298 With means to rotate clamp about fixed axis:

This subclass is indented under subclass 295. Subject matter involving means for mounting one said instrumentality for bodily turning motion about a stationary pivotal bearing, and a power-transmitting element for forcibly turning said instrumentality during an operation of the class type.

- (1) Note. Similar devices, but lacking pivotal bearing structure, may be found in subclass 303, the turning effect is limited by a short curved or bowed trackway in most instances.



Work deformed by relatively pivoted clamps (subclass 298)

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 80+, for deformation of rotating work which may be held in a rotary clamp or chuck.
303, for a metal tire upsetter of the like, and see (1) Note above.

- 310, for deformation by the pivotal motion of a work clamp with respect to a passive tool.
- 371, for coiling or twisting procedure which may involve a disclosed rotary work clamp or gripper.
- 299 About axis intersecting work-gripping regions of two clamps (e.g., twisting):**
This subclass is indented under subclass 298. Subject matter wherein said pivot line extends directly between the opposed jaws or surface elements of the work-gripping instrumentalities.
- (1) Note. This subclass generally relates to twisting a gripped rod or bar along its axis, for examples of “offset” twisting or “warping”, see subclass 298 and subclass 295 above. For similar operations involving axially moving work, see subclasses 64+ above.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 64+, for twisting axially moving work.
127+, for deflecting bodily moving work.
371, for a coiling or twisting method.
381+, for an offset-face-tool complex capable of twisting work (e.g., a crank-shaft).
- 300 With interrelated clamp closer and clamp mover:**
This subclass is indented under subclass 295. Subject matter utilizing means to move one or more of said clamp jaws or surface elements to effective (i.e., work-gripping) position, which means cooperates significantly with the means to move said movable instrumentality.
- (1) Note. For placement in this subclass, there must be structure to interrelate the clamp-closing and clamp-moving means; spring-biased or self-actuated clamps (responsive to initial movement of the work) do not meet this requirement.
- (2) Note. If metal deformation is accomplished by the closing of the clamp, the latter does not qualify as a “work-gripping clamp” for subclasses 293+ but constitutes instead an opposed-faced tool couple.
- (3) Note. If the clamp is so adjusted or controlled as to allow slippage of the work during metal deformation, it is regarded as a tool element or tool couple for placement elsewhere in the schedule.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 312+, for interrelated clamp closer and tool mover.
417, for interrelated tool mover and blank-holder mover.
- 301 With bodily motion in fixed path:**
This subclass is indented under subclass 295. Subject matter wherein the means to move or guide said movable instrumentality is effective to restrict the motion of said instrumentality to the same path whenever the motion occurs.
- (1) Note. Excluded, for example, would be a device wherein a work clamp is guided and moved solely by such manipulable means as a chain or a block and tackle, so that its path of motion is not positively restricted to a definite line.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 295, for metal deformation by two relatively movable work-gripping clamps one of which is freely manipulable, and see (1) Note above.
306+, and 308+, for metal deformation by a bodily movable clamp and a coacting tool other than a clamp.
- 302 Substantially direct approach or recession (e.g., stretching):**
This subclass is indented under subclass 301. Subject matter wherein the restriction of the path of motion of said movable instrumentality is to a straight or slightly curved line which if extended would intersect another work-gripping instrumentality.
- 303 Along curved path (e.g., tire upsetting):**
This subclass is indented under subclass 302. Subject matter wherein the restriction of the path of motion is to a nonlinear or slightly curved line.

- (1) Note. A typical device of this subclass is a tire upsetter comprising clamps for gripping spaced portions of a metal tire and means for urging the clamps toward each other along a path corresponding generally to the curvature of an average tire.
- (2) Note. For apparatus affording truly pivotal motion of a clamp in metal deforming, see preceding subclasses 298+; in such devices, there need be no translatory motion of the clamp; the deformation is usually of a bending or twisting nature.

SEE OR SEARCH THIS CLASS, SUBCLASS:

298+, for metal deformation by rotation of a work-gripping clamp about a fixed axis with respect to a fixed clamp, and see (2) Note above.

304 With work-distorting clamp:

This subclass is indented under subclass 293. Subject matter wherein the jaws of said work-gripping instrumentality are specifically modified for the purpose of temporarily deflecting or springing work from its initial shape while it is held in said jaws during an operation of the class type.

- (1) Note. This type of clamp is employed to counteract, forestall, or prevent possible undesired deformation of untreated portions of the work, such as may occur in flanging the periphery of a circular plate in a step-by-step manner.
- (2) Note. The deflection of distortion effected by the clamp is only temporary (i.e., within the elastic limit of the work material), see (2) Note under subclass 300 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

701, and 702, for distortion prevention, generally.

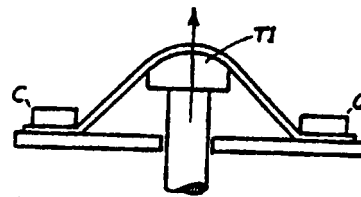
SEE OR SEARCH CLASS:

83, Cutting, subclass 176 for means to distort work temporarily for a cutting operation.

305 With plural-spaced clamps:

This subclass is indented under subclass 293. Subject matter wherein the work-gripping instrumentality cooperates with another work-gripping instrumentality cooperates with another work-gripping instrumentality located at a fixed distance therefrom.

- (1) Note. For original placement in this subclass, there must be structure to effect friction gripping engagement on significantly spaced portions of the same work-piece; e.g., adjacent two distinct edges of a sheet or at different points along the length of a rod, usually accompanied by a metal-deforming operation adjacent each clamped portion or between two clamped portions. One clamp may, however, have merely a steadying or stabilizing function.
- (2) Note. Some "stretch formers" are found in this subclass; i.e., those in which the work clamps are relatively fixed during metal deformation.



Relatively fixed clamps and actuated tool (subclass 305)

SEE OR SEARCH THIS CLASS, SUBCLASS:

295+, for method or machine employing plural relatively movable work clamps to deform work.

306 Plural or complex apparatus (e.g., with plural operations):

This subclass is indented under subclass 293. Apparatus comprising (a) three or more relatively movable tools, or (b) additional metal-

deforming apparatus of a type other than that of subclass 293 and which itself constitutes subject matter for this class (72).

- (1) Note. This subclass is the locus for patents relating to a plural tool couple* or a tool complex* and involving a work clamp which is nondeforming, per se. Typically, the machine performs a plurality of distinct metal deforming operations on the clamped work. Also included are all combinations of two or more metal-deforming machines not provided for above, wherein a work clamp is a claimed element of one machine.

SEE OR SEARCH THIS CLASS, SUBCLASS:

295+, for a possible combination of two or more metal-deforming machines, wherein one machine effects deformation by relatively movable clamps.

307 With means to advance elongated work (e.g., pipe elbow crimper):

This subclass is indented under subclass 306. Device comprising structure arranged to propel stock material or a relatively long blank in the direction of its length toward the zone of the metal-deforming operation.

- (1) Note. A typical device of this subclass crimps successive portions of an intermittently fed tubular blank to form a pipe elbow.

SEE OR SEARCH THIS CLASS, SUBCLASS:

405.01+, for means to feed work between plural tool stations.

419+, for means to handle work or product.

308 Clamp is active metal-deforming element:

This subclass is indented under subclass 293. Subject matter which accomplishes metal deformation, the forcible movement of said work-gripping instrumentality.

- (1) Note. In devices of this subclass, deformation is effected by the clamp's forcible movement of clamped work against one or more tool elements. For a device involving a movable work clamp used

merely to advance or index work between operations, see subclass 311.

SEE OR SEARCH THIS CLASS, SUBCLASS:

80+, for means to hold and rotate work during metal deforming by tool.

149+, for metal deforming by moving work holder form and work-contacting wiper.

274+, for moving work gripper in rod-, tube-, or wire-drawing.

295+, for a method or machine employing two or more relatively movable work clamps, any or all of which may constitute active metal-deforming element.

311, for clamp which is movable while holding work, and see (1) Note above.

309 With coacting movable tool:

This subclass is indented under subclass 308. Subject matter wherein the coacting work-engaging instrumentality also moves.

SEE OR SEARCH THIS CLASS, SUBCLASS:

381+, and 394+, for somewhat similar apparatus which lacks a nondeforming work-gripping clamp.

310 Clamp rotatable about fixed axis (e.g., bending brake):

This subclass is indented under subclass 308. Subject matter wherein the movement of said work-gripping instrumentality consists of turning with respect to a stationary pivot line.

- (1) Note. Conventional sheet metal bending brakes employ relatively pivoted clamp and bending tool or apron. The pivoted-clamp type is found in this subclass; for the fixed clamp type, see subclasses 316+ below. Bending brakes and other devices without work clamps will be found in subclasses 380+ and following subclasses.

SEE OR SEARCH THIS CLASS, SUBCLASS:

298+, for metal deformation by two relatively rotatable work-clamps.

- 303, for metal deformation by the approach of two work clamps along an arcuate path.
- 316+, for metal deformation by a tool movable against work held in a fixed clamp, and see (1) Note above.

311 **Movable clamp:**

This subclass is indented under subclass 293. Subject matter utilizing means to move or to guide the motion of said work-gripping instrumentality from one orientation or location to another while in effective work-gripping condition.

- (1) Note. For placement in this subclass, the combination must comprise a work clamp which is mounted for rotary or translatory movement during its actuated (closed) condition. The clamp may be, for example, one of a plurality of clamps on the turret, dial, or other work conveyor of a multi-tool station press; and it is not in motion during deformation of the gripped work.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 308+, for metal deformation by movable clamp and coacting tool.
- 405.01+, for means to move work between plural tool stations.
- 419+, for means to handle work or product.

312 **With interrelated clamp closer and tool mover:**

This subclass is indented under subclass 293. Subject matter wherein means to move one or move of said clamp jaws or surface elements to effective (i.e., work-gripping) positions, cooperates significantly with the means to move said movable instrumentality.

- (1) Note. Self-actuated, or camming-type clamps have no "actuating means" other than the work itself, hence, are not placeable in this subclass.
- (2) Note. The cooperation characteristic of this subclass may be an interlock (e.g., to prevent release of work while a tool is in motion), or a timing effect, or actual joint, or interconnected drive means for clamp closer and tool mover.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 300, for interrelated clamp actuator and clamp mover.
- 350+, for interrelated tool mover and yielding blank-holder in a deep-drawing press.
- 417, for interrelated tool mover and blank-holder actuator.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 374+ for interrelated work immobilizer (e.g., clamp) and tool actuator in a cutting machine.

313 **Jaw actuator driven by tool or tool holder:**

This subclass is indented under subclass 312. Subject matter wherein said movable instrumentality or means rigid therewith is arranged to transmit actuating force to move one or more clamp jaws or surface elements to effective (i.e., work-gripping) position.

- (1) Note. In a device of this type, the movable clamp jaw may be yieldably mounted on the tool holder or press ram and arranged to engage the work in advance of the moving tool.
- (2) Note. Metal drawing presses frequently employ a work clamp or "blank-holder" which is actuated by the tool slide or press ram. Such an arrangement is proper subject matter for this subclass, provided there is no disclosure of work slipping or deformation in the blank holder; cf., (2) and (3) Notes under subclass 300.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 385+ for clamp actuator driven by tool or tool holder in a cutting machine.

314 **Mechanical actuator:**

This subclass is indented under subclass 312. Subject matter involving the use of a lever, cam, gear, or other rigid force-modifying power-transmitting element to move a clamp jaw toward effective (i.e., closed) position.

315 Cam or toggle:

This subclass is indented under subclass 314. Subject matter wherein said rigid power-transmitting element constitutes a portion of a cam or toggle as defined in Class 74, subclasses 567 and 520, respectively.

316 Clamp structure constitutes sole initial metal-deforming force reaction means (i.e., is passive tool):

This subclass is indented under subclass 293. Subject matter wherein said opposed solid jaws or surface elements, together with any integral or rigid extensions thereof, are designed and intended to furnish the entire resistance to movement or deformation of work when the latter is subjected to forcible engagement by the coacting relatively movable instrumentality, at least during the earlier portion of an operation of the class type.

- (1) Note. A device of this subclass employs a work clamp as the passive element of a tool couple (i.e., the clamp functions as anvil or die); in some other types of metal-deforming devices a work clamp, if present, may contribute little or no reaction force and serve merely as a positioning means for work. (See subclass 293 for disclosures of such devices).
- (2) Note. Clamp structure within the meaning of the subclass definition may comprise, for example, an actuated work-gripping jaw cooperating with the press bed or anvil itself; the bed or anvil then constitutes an integral extension of clamp jaw proper.
- (3) Note. Other structure may be provided to assume more or less of the reaction force subsequent to initial displacement of work material; for auxiliary shape-imparting (die) structure rigid with the clamp, see subclasses 320+ and 322+.
- (4) Note. Many of the devices in the preceding subclasses employ clamps which meet the limitations of this subclass; a search on this feature will therefore involve most of subclasses 293+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

67+, for deformation of work held or clamped by various means and operated upon by a tool rotating or gyrating about a motion center within the confines of the work.

317 With plural selectively usable clamps (e.g., tube flarer):

This subclass is indented under subclass 316. Subject matter comprising two or more instrumentalities each capable of gripping work, only one of which is employed at any given time to clamp work during an operation of the class type.

- (1) Note. Typical of this subclass is a tube-flaring tool having clamping jaws which include a plurality of semicircular mating recesses of varying sizes along the inner facing edges of the jaws, the selected pair of mating recesses constituting a clamp for accommodating a tube to be flared.
- (2) Note. Not all tube flarers employ nondeforming work clamps. If work is deformed upon tightening of the jaws, the combination may be placeable in subclass 356 or 357 if a closed die is involved, otherwise in subclasses 394+ as an opposed face tool complex*.

SEE OR SEARCH THIS CLASS, SUBCLASS:

116, for plural selectively usable fixed tools for cooperation with an orbiting or rotating tool.

318 Deforming indeterminate-length work:

This subclass is indented under subclass 316. Subject matter utilizing structure adapted to hold or present to the action of a metal-deforming instrumentality a portion of a workpiece of unrestricted length.

- (1) Note. Typical apparatus of this subclass employs a reciprocatory heading punch to upset the projecting end of a rod or wire which is fed from the rear into a pair of opposed gripping jaws. (A bolt or nail header also usually comprises cutoff

means which, if claimed, would place the combination originally in preceding subclass 294).

- (2) Note. Any claimed deformation of work by the closing of the “gripping jaws” prior to or concurrently with the action of the heading punch, is evidence that the “jaws” are actually part of a tool complex*, for placement in subclasses 353.2+ or subclasses 394+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

293+, for similar apparatus wherein the work-holding means constitutes a nondeforming clamp.

353.2+, for deformation of work by a closed die tool complex* wherein two or more tools coact to grip partially deformed work for further treatment by a third tool.

357, for actuated split die and coacting closed die.

319 With pivotal tool (e.g., sheet metal bender):

This subclass is indented under subclass 316. Subject matter wherein said co-acting relatively movable instrumentality is restrained to rotation about a fixed axis.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

298+, for relatively pivoted nondeforming work-gripping clamps.

310, for pivoted work clamp (i.e., tool) and coacting fixed tool.

387+, for offset tool face couple comprising a pivoted tool element (e.g., a pipe or rod bender without claimed clamping means).

320 With die surface extending from clamp jaw:

This subclass is indented under subclass 319. Subject matter utilizing an element integral with or rigidly attached to a jaw of said work-gripping instrumentality, said element having a work-shape-imparting surface which is designed and intended to be engaged by, and to restrain movement of, portions of work at some time during an operation of the class type, said surface being nonplanar and/or offset or inclined with respect to the work-engaging face of said jaw.

- (1) Note. A flat surface extending from a clamp jaw and initially contacted by work, so that it serves mainly or entirely as a support and has little or no shaping function, is not regarded as a “die surface” for this subclass; see DIE* in the Glossary. A press bed on which work is held down by clamping fixtures would usually constitute a passive M.D. tool for subclass 316.

- (2) Note. A bevelled or rounded edge on a clamp jaw, unless it has a disclosed shaping function, is not regarded as a die surface. Many clamps are cut away or bevelled merely for clearance purposes, in such devices as sheet metal bending brakes, pipe benders, etc.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

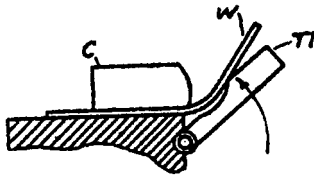
322+, for a work clamp having die surface extension, combined with active metal-deforming tool having other than pivotal motion.

462+, for a metal-deforming tool of specific configuration.

321 Curved die surface:

This subclass is indented under subclass 320. Subject matter wherein said work-shape-imparting surface comprises at least one arcuate or nonplanar portion.

- (1) Note. A device of this subclass may be employed to bend pipe about a fixed radius forming block, or to form a sheet metal cornice molding, where other than a simple sharp angle bend is desired.
- (2) Note. This subclass contains disclosures of some metal sheet folders which function to bend the sheet double about a thin wedge or plate extending from a clamp jaw. It is presumed, in the absence of detailed disclosure, that the folding edge is rounded to some extent, to avoid cracking or cutting the work.



Pivoting tool coacting with curved die surface extension on passive clamp (subclass 321)

322 With die surface extending from clamp jaw:

This subclass is indented under subclass 316. Subject matter utilizing an element integral with or rigidly attached to a jaw of said work-gripping instrumentality said element having a work-shape-imparting surface which is designed and intended to be engaged by, and to restrain movement of, portions of work at some time during an operation of the class type, said surface being nonplanar, and/or offset or inclined with respect to the work-engaging face of said jaw.

- (1) Note. See (1) and (2) Notes under subclass 320 for discussion of "die surface".

SEE OR SEARCH THIS CLASS, SUBCLASS:

320+, for metal deformation by die surface extension of work clamp and a co-acting pivoted tool.

SEE OR SEARCH CLASS:

269, Work Holders, subclasses 87+ for a work clamp or vise with nominally recited tool couple element.

323 Plural die surface portions and co-acting tools:

This subclass is indented under subclass 322. Subject matter utilizing two or more work-shape-imparting areas extending from clamp jaw structure, and a relatively movable tool associated with each area and effective to force work against its associated shape-imparting area at some time during an operation of the class type.

- (1) Note. A device of this type is commonly used to bend the two end portions of a centrally clamped rod or bar into U-

shaped form against cheeks on the clamp jaws.

SEE OR SEARCH THIS CLASS, SUBCLASS:

400+, for a similar tool arrangement (opposed face tool complex*) but without a claimed clamp.

324

WITH CUTTING:

This subclass is indented under the class definition. Subject matter comprising method of or means for systematic cutting* of the material which is the subject of metal deformation.

- (1) Note. See section VI, paragraph B, of this class for the relation of this class to other classes involving cutting, for a statement of the subject matter included in this class, and for examples of included and excluded combinations.
- (2) Note. This subclass and the subclasses indented hereunder are the locus for (a) combinations of metal-deforming machines (or subcombinations thereof), or metal-deforming implements or tools; with actuatable cutters or organized cutting devices; and for (b) methods involving metal deformation and cutting, if not excluded by the class definition or provided for in preceding subclasses relating to specialized methods or apparatus (e.g., rolling, extrusion, etc.).
- (3) Note. The presence of sharp points or edges on tools is not sufficient to identify the tools as "cutters" for any cutting subclass in Class 72, unless as disclosed (a) they effect complete penetration of the work (with or without severance or removal of material), or (b) they effect a claimed cutting, incising, piercing, splitting, breaking, etc., as distinguished from mere deformation of material.
- (4) Note. A claimed tool for cutting and deforming metal, but constituting less than an organized apparatus (e.g., lacking actuating means or coacting tool, etc., is subject matter for subclass 464.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 40, for cutting (e.g., grinding or turning), in mechanical cleaning combined with metal deformation.
- 55, for cutting combined with metal deformation by pressurized fluent material.
- 70+, for cutting combined with metal deformation by a tool rotating relatively to work about a motion center within work.
- 129+, for cutting combined with metal deformation by deflecting bodily moving work.
- 185+, for cutting with metal deformation by a "flying" tool.
- 203+, for cutting with roller or similar operation.
- 254+, for cutting with extrusion.
- 275, for cutting with rod, wire, or tube drawing.
- 294, for cutting with metal deformation by use of work-gripping clamp and relatively movable clamp or tool.
- 464, for a combined or composite metal-deforming and cutting tool; and see (4) Note to this subclass above.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 33+ for a "combined machine" excluded from this class (72) for reasons outlined in Lines With Other Classes, Relationship to Combination Classes, With Cutting of this class.
- 30, Cutlery, for a cutting implement or a work-supported cutter.
- 82, Turning, for cutting rotating work.
- 83, Cutting, for method or apparatus for cutting in general; see the class definition and notes for the locations of disclosures of various kinds of cutting and combinations with other operations.
- 225, Severing by Tearing or Breaking, for breaking or tearing apparatus.
- 227, Elongated-Member-Driving Apparatus, appropriate subclasses for a disclosure of cutting and deforming apparatus associated with a nail-driving device.

- 408, Cutting by Use of Rotating Axially Moving Tool, appropriate subclasses for cutting of that class type. The combination of cutting in a Class 408 manner with metal deforming of this class (72) will be found in this class.
- 409, Gear Cutting, Milling, or Planing, for other machining process or apparatus.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 289+ for apparatus for shaping or reshaping nonmetals not otherwise provided for combined with preform severing means.
- 451, Abrading, subclasses 38+ for a process of sandblasting and subclasses 75+ for a machine for sandblasting.
- 470, Threaded, Headed Fastener, or Washer Making: Process and Apparatus, appropriate subclasses for metal deformation associated with cutting in the art of fastener making, except as provided for in Class 408.

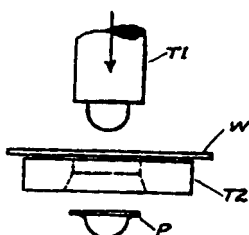
325

By composite tool (e.g., piercing):

This subclass is indented under subclass 324. Subject matter wherein cutting is effected by means comprising a pointed or edged element rigidly attached to or constituting a portion of a disclosed metal-deforming tool*, which element engages work at some time during the disclosed motion of said tool or during the disclosed motion of an associated metal-deforming tool forming therewith a tool couple*, during which disclosed motion an operation of the class type is also performed upon the same work or upon metal material integral therewith.

- (1) Note. A composite metal-deforming and cutting tool may be either an actuated or a fixed tool, or there may be co-acting cutting edges on both elements of a metal-deforming tool couple.
- (2) Note. The cutting may take place before, during, or after a claimed deforming operation by said tool upon the same workpiece or upon integrally connected material (such as stock, partially treated work, undetached product portion, etc.). It must in all cases be regularly associated with a deforming operation, i.e., in the same tool stroke, and not as an optional or alternative use of the tool.

- (3) Note. This subclass is the residual locus for patents directed to process or apparatus involving a composite tool which cuts by sawing, drilling, tearing, nipping, incising, puncturing, or other nonshearing action. See following diagram for an example of a composite tool; (other examples in subclasses 327 and 330).
- (4) Note. See search notes under subclasses 464 of this class for listing of other subclasses providing for composite cutting-deforming tools.



Composite cutting-and-deforming tool (subclass 325)

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 204, for a roller-type composite tool.
- 324, 340 and 341, for a nonshearing cutting device combined with a metal-deforming device, or for method involving such cutting and metal deformation.
- 464, for a composite tool, per se.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 566.1+ for a cutter with noncutting work modifying means.
- 428, Stock Material or Miscellaneous Articles, subclass 596 for apertured or slit metallic stock which may be the product of a piercing operation.

326 Shear-type:

This subclass is indented under subclass 325. Subject matter wherein said edged element and a coacting element having a generally conforming edge are arranged to engage opposite sides of work and to approach each other, with the edge on one element moving past, and in

close and overlapping relationship to, the edge of the coacting element.

- (1) Note. A cutting tool couple must cut completely through work in the direction of tool advance to be regarded as a shear-type cutter for this or indented subclasses; no material need be detached, e.g., slitting or fringing is frequently done by shearing cutters.

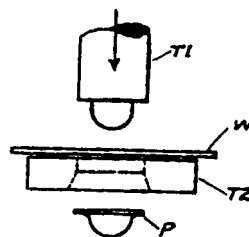
SEE OR SEARCH THIS CLASS, SUBCLASS:

- 332+, for the general combination of a shearing tool couple with a metal-deforming device or for method involving such cutting and metal deformation.

327 With endless cutting edges:

This subclass is indented under subclass 326. Subject matter wherein the shearing edge on each of said elements defines a closed curve in a plane normal to the direction of motion of the movable element(s).

- (1) Note. The cutting effected by an endless edge shearing couple is variously termed "punching", "die-cutting", "blanking", "stamping out", etc. In all cases, a discrete piece of material is detached (e.g., a blank, product, or waste) by a cut which encircles the detached piece, as indicated in the accompanying diagram.



Deforming work and severing product by endless-edge composite tool (subclass 327)

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 333+, for an endless edge shearing tool couple combined with a metal-deforming device, or for the corresponding method.

328 Utilizing stripper or ejector:

This subclass is indented under subclass 327. Subject matter comprising means for, or the use of means for, engaging, and thereby detaching or assuring the detachment of, a product, piece, or portion from a cutter which has produced or penetrated it.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 344+, for a stripper or ejector in a closed die metal-deforming apparatus.
- 427, for an ejector associated with a metal-deforming tool.

SEE OR SEARCH CLASS:

- 83, Cutting, appropriate subclasses under subclasses 78+ for a stripper or ejector in a cutting machine.

329 Blank detaching:

This subclass is indented under subclass 327. Subject matter wherein the cutting edges are so arranged with respect to the deforming face of the metal-deforming tool that they are effective to separate a discrete piece (as from stock material or a rough blank) prior to deformation of said discrete piece by said tool face.

- (1) Note. Substantially simultaneous engagement of work by shearing edges and metal-deforming tool faces is regarded as "blank detaching" for this subclass, for the blank is severed before any substantial amount of deformation has been performed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

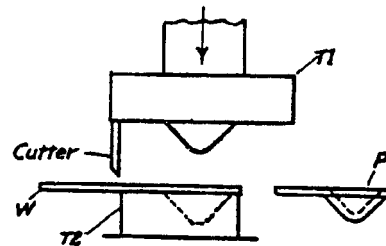
- 330, and 337, for blank detaching by cut-off shears.
- 339, for precutting by severing means other than shears.
- 366.2, for blank detaching by endless edge shearing cutters which do not form part of a composite tool.

330 Blank detaching:

This subclass is indented under subclass 326. Subject matter wherein the cutting edges are so arranged with respect to the deforming face of the metal-deforming tool that they are effective to separate a discrete piece (as from stock

material or a rough blank) prior to deformation of said discrete piece by said tool face.

- (1) Note. This subclass typically involves cutting off a length of a metal strip, rod, or wire for subsequent deformation by a tool face rigid with the cutter (See diagram).



Composite tool device for subclass 330. Blank is severed from stock prior to deformation in same tool stroke.

- (2) Note. Substantially simultaneous engagement of work by shearing edges and metal-deforming tool faces is regarded as "blank detaching" for this subclass, for the blank is severed before any substantial amount of deformation has been performed.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 337, for similar blanking by a shearing tool couple prior to metal deformation by another tool couple.

331 Severing (e.g., subdividing):

This subclass is indented under subclass 326. Subject matter, note provided for in preceding subclasses, comprising the detachment of a discrete piece of material from stock, work, or a product of metal deformation.

- (1) Note. This subclass accommodates shearing operations by composite tool in which metal deformation is accompanied by cutting for such purposes as (a) reduction of scrap, (b) subdividing a multiple product, (c) notching, (d) detaching product from end of stock, or (e) squaring or trimming a rough blank, etc., as distinguished from the blank

detaching from stock in subclass 330 above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

338+, for metal deformation with associated severing by means other than shears.

332 **By shearing tool couple:**

This subclass is indented under subclass 324. Subject matter comprising cutting by a plurality of coating edged tool elements which are arranged to engage opposite sides of work, and to approach each other with the edge on one tool element moving past, and in close overlapping relationship to, the edge of another tool.

- (1) Note. For original placement in this subclass, the shears must cut completely through the work in the direction of tool motion, but severing, i.e., detachment of material, is not required (fringing and slitting is frequently effected by shearing).

SEE OR SEARCH THIS CLASS, SUBCLASS:

326+, for a composite shearing and metal-deforming tool.

333 **With endless cutting edges (e.g., for punching a hole):**

This subclass is indented under subclass 332. Subject matter wherein the shearing edge on each of said elements defines a closed curve in a plane normal to the direction of motion of the movable element(s).

- (1) Note. See (1) Note under subclass 327.

334 **After final metal-deforming operation:**

This subclass is indented under subclass 333. Subject matter wherein the cutting tools are arranged to operate on a portion of a product subsequent to the last deforming operation thereon.

SEE OR SEARCH THIS CLASS, SUBCLASS:

338+, for severing a discrete piece from material (which may be a final product of metal deformation) by cutting means other than shears.

340, for machining after final deformation (e.g., grinding, drilling, turning, etc.).

335 **Precutting (i.e., before metal deforming):**

This subclass is indented under subclass 333. Subject matter wherein the cutting operation precedes any metal-deforming operation (a) in a sequence of method steps, or (b) in the disclosed operation of a machine.

- (1) Note. This subclass is intended to accommodate any cutting by a tool of the type proper to subclass 333 which occurs (a) prior to the initial metal-deforming treatment on a workpiece, (b) prior to any deforming operation in the same operating cycle of a machine, or (c) "upstream" of metal-deforming tool stations in a progressive punch press or the like.
- (2) Note. The cutting which characterizes this subclass is usually for the purpose of punching out slugs of waste material.

SEE OR SEARCH THIS CLASS, SUBCLASS:

324, for machining (drilling, grinding, etc.), prior to metal deformation.

339, for precutting other than by disclosed shearing with severance of a discrete piece.

336 **Blank detaching:**

This subclass is indented under subclass 335. Subject matter wherein the cutting effects complete severance of a discrete workpiece.

SEE OR SEARCH THIS CLASS, SUBCLASS:

329, for blank detaching by composite tool with endless cutting edge.

330, and 337, for blanking detaching by shearing tools in a different environment.

339, for severing by nonshearing means prior to metal deformation.

337 **Blank detaching:**

This subclass is indented under subclass 332. Subject matter wherein the cutting effects complete severance of a discrete workpiece prior to any deforming operation thereon.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

329, and 330, for blank detaching by shear-type composite metal-deforming and cutting tool.

338 Severing a discrete piece from stock, work, or product:

This subclass is indented under subclass 324. Subject matter, not provided for in preceding subclasses, wherein the cutting effects separation of a coherent portion of material from a parent body (such as stock, work, or product).

- (1) Note. This subclass is intended to accommodate the combination of metal deforming with means for, or a step of, detaching a piece of significant size from the material which is the subject of metal deformation, by a nonshearing type of cutting, e.g., sawing, breaking, tearing, nipping, etc., or by undisclosed or incompletely disclosed means, where it is evident that the separated portion is not intended to be reduced to chips or filings by the severing operation.
- (2) Note. The use of a saw or milling cutter for the disclosed purpose of subdividing, or separating a coherent piece from stock, etc., is regarded as “severing” for the purposes of this subclass.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

324, 340 and 341, for machining associated with metal deformation.

339 Precutting:

This subclass is indented under subclass 338. Subject matter wherein the severing precedes any metal-deforming operation.

- (1) Note. In addition to “blanking”, this subclass may include trimming or squaring of stock or of a rough blank, subdividing of a multiple blank, etc., by nonshearing or undisclosed means, where it is evident that the cut portions are not reduced to chips or shavings.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

329, and 330, for precutting (prior to metal-deforming) by a shear-type composite tool.

335+, for precutting by a shearing tool.

340 Machining after final metal deforming (e.g., grinding to size):

This subclass is indented under subclass 324. Subject matter, not provided for in preceding subclasses, and involving the conversion of a portion of product of metal deformation into chips, filings, etc., subsequent to the last deforming operation thereon.

- (1) Note. See (1) Note under subclass 338 above for severing by a machining operation.

341 Machining between plural metal-deforming operations:

This subclass is indented under subclass 324. Subject matter, not provided for in preceding subclasses, and involving the conversion of a portion of a product of metal deformation into chips, filings, etc., and followed by another deforming operation on the unconverted portion of said product.

- (1) Note. The term “product of metal deformation” denotes any piece, blank, or supply of coherent material upon which an operation of the class type has been performed; a product of metal deformation may thus constitute “work” for a succeeding deforming operation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

324, for machining or miscellaneous nonshearing cutting operation prior to metal deformation.

340, for machining after final metal deformation.

342.1 With temperature modification of tool or of specified portion of work:

This subclass is indented under the class definition. Subject matter comprising means for or a step of localized heating or cooling of a tool* of a metal deforming device and/or of a limited and particularly denoted part of the work.

- (1) Note. The general heating or cooling of a machine or of work material is excluded from this subclass, and a disclosure thereof is to be placed with the class type of deforming method or apparatus claimed.
- (2) Note. The schedule of this class (72) does not distinguish generally between “hot” and “cold” work in patent claims, for this feature is not consistently specified in the claims. Subclasses in certain areas of the schedule recognize heating or cooling as significant (see subclass 286, for example, in the wire or tube drawing art).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 8.5, 12.2, 16.4, and 18.3, for metal deforming with use of control means energized in response to an activator stimulated by a sensor responsive to the temperature of work or product.
- 69, for metal deforming by use of a tool acting during relative rotation about an internal center with modification or control of temperature of work, tool, or machine; or with lubrication thereof.
- 128, for metal deforming by deflecting with modification or control of temperature of work, tool or machine.
- 200, for metal deforming by a roller with modification or control of temperature of work, tool or machine.
- 286, for metal deforming by pulling a workpiece through a closed periphery die with heating or cooling.

342.2 Cooling:

This subclass is indented under subclass 342.1. Subject matter comprising means for, or a step of localized cooling (i.e., lowering the thermal energy of) a tool* of a metal-deforming device and/or of a limited and particularly denoted part of the work.

342.3 Of tool:

This subclass is indented under subclass 342.2. Subject matter comprising means for or a step of localized cooling of a tool* of a metal deforming device.

342.4 And heating of tool:

This subclass is indented under subclass 342.3. Subject matter also comprising localized heating (i.e., raising the energy level) of the tool.

342.5 And heating of work:

This subclass is indented under subclass 342.2. Subject matter comprising heating (i.e., raising the thermal level of the material being deformed).

342.6 Distinct temperature modifications at distinct locations of workpiece:

This subclass is indented under subclass 342.5. Subject matter comprising provision to establish a thermal level at one portion of the material being deformed and at a different thermal level at a different portion of the material.

342.7 Of tool:

This subclass is indented under subclass 342.1. Subject matter comprising means for or a step of localized heating or cooling of a tool* of a metal-deforming device.

342.8 Preheating:

This subclass is indented under subclass 342.7. Subject matter comprising heating or cooling of a tool before application of the tool to the metal deforming action to prepare that tool to function in the manner as if it had previously been in operation.

342.92 By electrical resistance heater within tool:

This subclass is indented under subclass 342.7. Subject matter wherein the tool is heated by a device intended for that purpose which device utilize its resistance to the flow of electrical current to raise the thermal level of the tool.

342.94 Distinct temperature modifications at distinct locations of workpiece:

This subclass is indented under subclass 342.1. Subject matter comprising provision to establish a thermal level at one portion of the material being deformed and at a different thermal level at a different portion of the material.

342.96 By passing electric current through work:

This subclass is indented under subclass 342.94. Subject matter including provision to pass electricity through the workpiece, to uti-

lize the electrical resistance of the work to effect heating.

343 BY USE OF CLOSED DIE AND CO-ACTING WORK FORCER (E.G., PUSH-DRAWING):

This subclass is indented under the class definition. Subject matter comprising the use of a movable member and means to move, or guide the motion of, said member during an operation of the class type, said movable member being effective to forcibly propel or press work (a) into and through a work shape-imparting orifice*, or (b) into or within a passageway* or die cavity* having a closed perimeter definable in a plane normal to the direction of motion of said member, the work being moved by said member to such an extent that at least a portion of the work has impressed therein or thereon a shape which is substantially congruent with the edge of said orifice or with some portion of said perimeter.

- (1) Note. The term “movable” is used in a relative sense. Either, or both of, the work-forcer and the shape-imparting structure may be movable during the deforming operation, and the work forcer may also constitute a closed die*.
- (2) Note. These subclasses (343) are the loci for original placement of all closed die apparatus and method patents, except those including an accompanying feature (such as cleaning, or lubrication, or cutting) provided for in preceding subclasses, or certain specific apparatus or techniques (such a metal deformation by pressurized fluid, or by extrusion) which have been selected for collection ahead of general “closed die” operations.
- (3) Note. This subclass (343) is the residual locus for a method of, or apparatus for, metal deformation into and/or within an open-ended passageway, as distinguished from a closed bottom die cavity (e.g., pushing a rod or tube through a die to reduce its diameter, or die-forging an automobile valve head while providing an open-ended die passageway for the formation of a stem portion of unrestricted length). Some operations inaccurately called extrusion are properly

classified in this subclass, wherein metal is not actually forced outwardly away from the die or past the most constricted portion of a passageway.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 61+, for the expansion of hollow work by fluid pressure within a die.
- 127+, for metal deformation by deflecting (e.g., bending, coiling, “skelping”, or longitudinally troughing) bodily moving work, by passing it through a tool station which may include a closed die.
- 253.1+, for extrusion through an orifice.
- 274+, for rod-, tube-, or wire-drawing by pulling through a closed die.
- 293+, for metal deformation by use of a non-deforming clamp and relatively movable tool.
- 317, and 318, for a disclosure of closed die apparatus.
- 352+, for apparatus employing a closed die of the die cavity, or closed bottom type, as distinguished from a through die usable in extruding or wire-drawing.
- 467+, for closed die structure, per se.

SEE OR SEARCH CLASS:

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 394+ for coacting shaping surfaces for reshaping nonmetallic preforms; and subclasses 406+ for press forming apparatus for nonmetallic fluent materials, see the search notes thereunder.

344 With stripping or ejecting from tool:

This subclass is indented under subclass 343. Subject matter comprising an instrumentality, or the step of using an instrumentality, which is effective to cause or to assure such relative motion between a product of metal deformation and a tool as to detach and remove said product from said tool.

- (1) Note. The instrumentality may be active or passive, e.g., it may be a fixed projection against which an article clinging to a retracting tool is struck and dislodged from the tool.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 134, 169, 250, and 257, for product handling, stripping, or ejecting associated with some other type of metal-deforming apparatus.
- 328, for a stripper or ejector associated with a composite (deforming and cutting) tool.
- 361, for product handling associated with closed die apparatus.
- 419, for means to handle product in metal-deforming apparatus.
- 427, for an ejector associated with metal-deforming apparatus.

345 **Timed with tool motion:**

This subclass is indented under subclass 344. Subject matter comprising means for, or the step of utilizing means for, moving said instrumentality in a definite temporal relationship to the movement of said tool.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 417, for timed relationship between tool motion and blank holder motion.
- 421, for timed tool and work moving means.
- 426+, for product handling means, including ejector, associated with metal-deforming apparatus.

346 **With work feeding:**

This subclass is indented under subclass 345. Subject matter comprising means for, or the step of utilizing means for, advancing or guiding work to the tool zone, prior to an operation of the class type.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 361, for holding, handling, or guiding of work in connection with metal deformation by closed die apparatus.
- 419, for means to handle work in metal-deforming apparatus.

347 **Cup or shell drawing (i.e., deep drawing):**

This subclass is indented under subclass 343. Subject matter wherein said movable member comprises a head or shoulder designed and intended to abuttingly engage work, and which

head or shoulder is movable, while engaged with a first portion of the work, into and past said orifice or into a substantially cylindrical or parallel-sided work shape-imposing section of said cavity or passageway, at least some other portion of work material being pulled by said first portion into such forcible engagement with the wall of the orifice, cavity, passageway, as to have impressed thereon a shape corresponding to said engaged wall.

- (1) Note. Apparatus of this subclass is intended to operate on work of initial dimension larger than the work-shaping opening. The product may be a discrete cup or shell having the dimension of the opening, and with or without a flange, rim, or undrawn material left attached localized drawn portion such as a flanged opening (see diagram under subclass 350).
- (2) Note. Although the typical product is cylindrical in form, apparatus of this subclass may be used to draw a tapered object, if sufficient clearance is provided between plunger and draw ring (closed-die); the product may also be of interrupted or segmental form as determined by the initial shape or size of the blank.
- (3) Note. If the plunger merely pushes material into a die cavity without itself entering the cavity, the operation is closed die forging for subclass 352; if the plunger (or male die) enters the die cavity but does not reach a cylindrical or parallel-sided portion thereof while pulling work therewith (i.e., subclasses 347+), see subclasses 358+. Deep drawing may be accompanied by die forging, embossing, etc., for which see subclass 348.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 348+, for deep-drawing (means or method) combined with other metal deformation.

348 **With additional metal deforming:**

This subclass is indented under subclass 347. Subject matter further comprising organized apparatus or a method step of a type which itself constitutes subject matter for this class.

- (1) Note. Any other claimed deforming operation, such as die forging, embossing, bending, etc., combined with an operation which qualifies as "deep drawing: is proper subject matter for this subclass. (Often a portion of a tool couple effects deep drawing, while other portions operate in other ways upon the same work, as for flanging, bending, embossing, etc.).

349 Plural deep drawing:

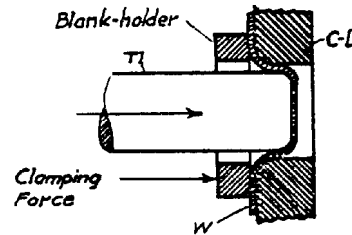
This subclass is indented under subclass 348. Subject matter wherein the additional apparatus or method step itself would constitute subject matter for subclasses 347+.

- (1) Note. A method comprising two or more steps of deep drawing, or apparatus for performing such steps, with or without additional metal deforming is proper subject matter for this subclass.

350 With application of frictional restraining force to work during deformation:

This subclass is indented under subclass 347. Subject matter utilizing a nonpositive work gripper and actuating means for making said gripper effective to engage work, said actuating means or said gripper embodying adjustable or yieldable structure which is intended to be capable of so limiting or regulating the force of engagement of said gripper with the work as to permit movement (i.e., slippage) of a portion of the gripped work in response to internal stresses developed therein by and during the motion of said movable member.

- (1) Note. Subclasses 350+ is loci for deep-drawing apparatus utilizing a "blank holder" or "clamping ring" which is so actuated that it permits work material to slip gradually into the bore of the draw ring or die during the drawing of a cup or shell. The slippage of work under frictional restraint distinguishes the blank holder of this subclass from the nondeforming work gripping clamp which characterizes preceding subclasses 293 (see accompanying diagram).



Deep-drawing with frictional restraint on work (subclass 350).

- (2) Note. The blank holder of this subclass has the effect of a metal-deforming tool or tool couple acting to modify the operation of the plunger and draw ring. Similar structure may be found in subclasses 312+, where, however, no yielding or slippage function is disclosed or desired.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 293+, for a positively gripping blank-holding clamp and coating metal-deforming tool.
417, for interrelated blank holder mover and tool mover.

351 With yieldable actuation of work gripper (e.g., spring biased blank holder):

This subclass is indented under subclass 350. Subject matter wherein the means for actuating said gripper comprises a force responsive (e.g., deformable, resilient, or slipping) element forming part of the force-transmitting train, such element serving to limit the force exerted on and by said gripper.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 382, and 396+, for yieldable face portion or auxiliary tool in a tool complex*; such yieldable element frequently has a work-holding function in addition to its deforming function.
431+, for yieldable connection in drive train to a movable tool.
453.1+, for pneumatic- or fluid-actuated tool support.
465.1+, for flexible or yieldable tool or tool support.

SEE OR SEARCH CLASS:

83, Cutting, subclass 460 for a clamp driven by yieldable means in a cutting machine.

352 Forcing work into closed die; e.g., forging:

This subclass is indented under subclass 343. Subject matter wherein the operation is disclosed as having been completed while the deformed work material remains in the interior of the closed die.

- (1) Note. Apparatus of this and the indented subclasses typically embodies a closed bottom die, rather than the through die which characterizes extrusion or wire-drawing devices in preceding subclasses 253.1+ and 274+. Deep drawing is sometimes effected in closed bottom dies of suitable configuration (i.e., with cylindrical wall section, see subclass 347).
- (2) Note. The product of this and the intended subclasses is usually formed in three dimensions as a discrete object, e.g., a drop-forged article, or as a localized deformation of stock material or of a larger object (e.g., a bolt head upset at the end of a rod) as distinguished from the continuous or indefinite length products of many through die operations.
- (3) Note. A complete search for closed bottom closed die apparatus or method will involve many of the preceding subclass areas in this schedule, particularly, deforming by fluid pressure (subclasses 54+), and by use of relatively movable clamp (subclasses 293+).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 61+, for metal deformation by use of fluid pressure and fixed die for expanding hollow work.
- 293+, for metal deformation by work clamp and relatively movable tool (which may constitute a closed die).
- 462+, for a metal-deforming tool, per se.

SEE OR SEARCH CLASS:

267, Spring Devices, subclass 119 for a piston-type fluid spring device useful

as a press cushion in a sheet metal deforming, die cavity press; and subclass 130 for a spring device, other than fluid spring type for such use.

353.2 By two or more coacting tools movable relative to closed die; e.g., tool complex:

This subclass is indented under subclass 352. Subject matter including a first instrumentality for deforming the work in the closed die, or as it moves the work thereinto; and a second deforming instrumentality also for deforming the work in the closed die, or as it moves the work thereinto; wherein the first and second deforming instrumentalities move relative to each other and relative to the closed die during deformation of the work, in such manner that at some instant during the class type operation the closed die and both of the other deforming instrumentalities are in simultaneous contact with the same work.

- (1) Note. The first and second deforming instrumentalities may have any location or any type of stroke. There must be relative motion between the instrumentalities and the closed die during deformation, but any one of the tools may be stationary.
- (2) Note. This subclass relates to a closed-die tool-complex*, as distinguished from "plural metal-deforming apparatus" which involves alternately or sequentially advanced and withdrawn tools (or concurrently actuated tools which treat distinct workpieces).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 356, for plural (similar or diverse) metal-deforming apparatus, employing at least one closed-die device.
- 381+, for a tool-complex comprising an offset-face tool couple.
- 394+, for a tool-complex with opposed-face tools.
- 471, for a tool-couple with an intermediate tool.

353.4 Symmetrically expanding tools:

This subclass is indented under subclass 353.2. Subject matter wherein the first and second deforming instrumentalities are actuated to

move equally apart, toward the work, and with respect to the closed die during the deforming operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

392+, for similar symmetrically expanding tools not in combination with a closed die.

353.6 With tools converging to form annular surface; e.g., segments of closed die:

This subclass is indented under subclass 353.4. Subject matter wherein the closed die is comprised of a plurality of portions each covering an arc of the periphery thereof, which portions are movable radially with respect to each other, but not during metal deformation; or (2) including a closed die and including a plurality of components, each having a work engaging arcuate surface, wherein the components move simultaneously together to give the work a continuous circular surface.

- (1) Note. The “portions” of the closed die of clause (1) this subclass are not in motion during the deforming operation. Commonly the purpose of being segmented is to allow removal thereof from the formed product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, for peripherally spaced tools that move radially inwardly to effect a metal deforming operation, even if the tools mutually form an annular shaping surface at their radially innermost position, but do not comprise a “closed die.”

354.2 With tools converging to form annular surface; e.g., segments of closed die:

This subclass is indented under subclass 353.2. Subject matter wherein the closed die is comprised of a plurality of portions each covering an arc of the periphery thereof, which portions are movable radially with respect to each other, but not during metal deformation; or (2) including a closed die and including a plurality of components, each having a work engaging arcuate surface, wherein the components move simultaneously together to give the work a continuous circular surface.

- (1) Note. The “portions” of the closed die of clause (1) of this subclass are not in motion during the deforming operation. Commonly the purpose of being segmented is to allow removal thereof from the formed product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

402, for peripherally spaced tools that move radially inwardly to effect a metal deforming operation, even if the tools mutually form an annular shaping surface at their radially innermost position, but do not comprise a “closed die”.

354.6 One tool telescoping into closed die:

This subclass is indented under subclass 353.2. Subject matter wherein at least one of the deforming instrumentalities slidably enters into a parallel sided portion of the closed die during the deforming operation.

354.8 One yieldably connected to another:

This subclass is indented under subclass 354.6. Subject matter wherein force transmitted to one of the deforming instrumentalities is also transmitted to another deforming instrumentality by a yieldable medium such that even though both have a common drive or holding means, there is relative movement between those two instrumentalities during the deforming operation.

355.2 Coaxial opposed tools:

This subclass is indented under subclass 354.6. Subject matter wherein the first and second deforming instrumentalities are spaced from each other along a line and move parallel to that line, toward each other, and with respect to the closed die to effect the deforming operation on a workpiece therebetween.

- (1) Note. An ejector rod (knockout rod) or similar element which may lie in contact with work during a deforming operation but which has no independent motion until it is actuated to expel a formed product from a tool after the operation is completed, should be distinguished from a “first” or “second” instrumentality.

355.4 Passing through work; e.g., “punch”:

This subclass is indented under subclass 355.2. Subject matter wherein at least one of the deforming instrumentalities penetrates either singularly or in conjunction with the coaxial instrumentality all the way through the work-piece.

- (1) Note. The workpiece may be cylindrical when introduced to the deforming instrumentalities, or may be a billet that is forged to a tubular shape.

355.6 Both telescoping into closed die:

This subclass is indented under subclass 355.2. Subject matter wherein the coaxially opposed deforming instrumentality also slidingly enters into another cylindrical portion of a closed die during the shaping operation.

356 With additional metal deforming:

This subclass is indented under subclass 352. Subject matter which comprises or utilizes a second set of organized instrumentalities capable of effecting an operation of the class type.

- (1) Note. A device classified in this subclass consists of apparatus of subclass 352 type, combined in any manner and to any degree with similar apparatus or with apparatus classifiable, per se, in a lower subclass but falling short of qualifying as a tool complex* for subclasses 353.2+ above.

SEE OR SEARCH THIS CLASS, SUBCLASS:

348+, for deep drawing with additional metal deformation.

404+, for plural metal-deforming apparatus of types not provided for in preceding subclasses.

357 With actuation of split die:

This subclass is indented under subclass 352. Subject matter including utilization of a work-engaging member constructed in two or more relatively movable parts, separable to admit work and movable to closed position to confine work there between and to afford a shape-imposing surface or cavity adjacent to a portion of the work, said device further comprising a

power-transmitting train for moving said parts to closed position.

- (1) Note. For this subclass, the multipart work-holding or work-confining member must also constitute a die (i.e., must comprise a work-shape-imposing, or limiting surface which at some time during the movement of the coacting tool or work forcer is engaged by work), but it must not constitute a die couple. In other words, if parts of the work gripper deform work while closing into gripping engagement therewith, they constitute a tool couple; in combination with the relatively movable header or other tool they thus become a tool complex for subclasses 353.2+, 381+, or 394+.

- (2) Note. Usually, but not necessarily, the work gripper die surface defines a closed die cavity; however, the coacting tool may itself constitute the closed die and the gripper die surface may have any form, e.g., flat or segmental.

SEE OR SEARCH THIS CLASS, SUBCLASS:

312+, for interrelated work clamp actuator and tool mover.

353.2+, for closed die tool complex wherein two or more tools coact to grip partially deformed work, and see (1) Note above.

358 Tool portion enters cavity of closed die:

This subclass is indented under subclass 352. Subject matter wherein at some time during an operation of the class type at least a part of the work-engaging surface of the movable member intersects a plane normal to the direction of motion of said member and containing a closed perimeter portion of the die cavity or passageway.

359 With telescoping engagement:

This subclass is indented under subclass 358. Subject matter wherein said movable member substantially fills the opening presented by said die cavity or passageway, or wherein a portion of said member engages a complementarily shaped portion of the side wall of said die cavity or passageway during the movement of said member.

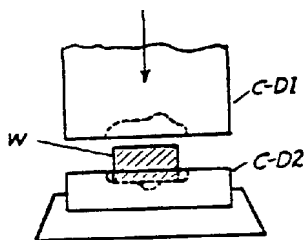
SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 333+, for some disclosures of telescoping metal-deforming tool and cutting tool.
- 355.6, for a closed die complex involving telescoping tools.
- 391.8, for a telescoping tool couple with off-set tool faces.

360 Co-acting closed dies:

This subclass is indented under subclass 352. Subject matter utilizing two opposed relatively movable closed die* structures.

- (1) Note. This subclass is the locus for apparatus comprising a conventional drop-forging die couple, as indicated in the accompanying diagram.



Metal deforming by coacting closed dies (subclass 360).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 348+, and 353.2+, for other disclosures of coacting closed dies.

361 With holding, handling, or guiding of work or product:

This subclass is indented under subclass 352. Subject matter not specifically provided for in preceding subclasses and utilizing structure which is designed and intended to (a) maintain or retain material in fixed position relative to metal-deforming apparatus, or (b) direct the course of moving work or product and/or (c) cause the movement thereof relative to metal-deforming apparatus.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 344+, for stripping or ejecting associated with closed die means or method.

- 419+, for work or product-handling means associated with metal-deforming apparatus, in general.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 78 for a cutting device with product-handling means; and appropriate subclasses for means to feed or guide work in specific types of cutting machines.

362 PROCESS:

This subclass is indented under the class definition. Method, , of deformation metal which is not classifiable in any of the subclasses herein-above.

- (1) Note. Metal-deforming processes claimed in combination with other metal treatments not particularly provided for in this class are generally excluded from this class. However, combinations which comprise a nonsignificant heat treatment and deforming of metal are placed here. See Lines With Other Classes, Relationship to Combination Classes, With HEat Treatment, paragraph 2 of Class 72 definition and Lines With Other Classes, Metal Casting, Metal Fusion Bonding, etc., the first paragraph, of the Class 148 definition to determine what constitutes significant heat treatment for Class 148.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 592+ for a process for making a miscellaneous article, that is, one whose manufacture is not the subject of a specific subclass. Except for subclasses 421.1+, these subclasses have not yet been screened and those which do not involve assembly (which are excluded from this Class 72) may contain subject matter similar to that found in this class.
- 76, Metal Tools and Implements, Making, subclasses 101.1+ for a process of making a tool or implement which may include a step of metal deformation, but which also includes another treatment, such as welding or assembly, which latter treatment (or which inclusion of extraneous subject mat-

- ter) operates to exclude the combination from this class (72).
- 428, Stock Material or Miscellaneous Articles, subclasses 544+ for metallic stock, e.g., of indefinite length, which may be the product of metal deforming operation; and especially subclass 600 of such stock having a variation in thickness.
- 363 Deforming stacked blanks:**
This subclass is indented under subclass 362. Process which includes the simultaneous or immediately sequential deformation of an ordered assemblage of workpieces in a face-to-face arrangement, the workpieces being intended, according to the disclosure, to be separated subsequent to deformation.
- (1) Note. The limitation "face-to-face" includes blanks separated by thin material such as goldbeater's skin.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
39+, and 46+, for deformation of stacked blanks preceded by coating for lubrication or other purposes.
- 364 With temperature maintenance or modification:**
This subclass is indented under subclass 362. Process including a step of evolving, maintaining, or modifying a thermal condition.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
342.1, for temperature modification of a tool or a specified portion of work.
- 365.2 "Rolling":**
This subclass is indented under subclass 362. Process which is described by the verb "roll" or a participial derivation thereof, but which as claimed does not employ sufficient identifying structural matter to warrant placement in a preceding subclass.
- 366.2 Between disclosed rollers:**
This subclass is indented under subclass 365.2. Process which as disclosed is accomplished by passing the work between one or more pairs of rollers*.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
199+, for a process of working metal by specific roller apparatus.
379.2+, for a patent including a process of bending sheet metal by rollers or rolling, but in which rollers or rolling are not claimed.
- 367.1 Tube making or reshaping:**
This subclass is indented under subclass 362. Process relating to the manufacture or deformation of a tube*.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
1+, 6.1+, 28.1+, 31.01+, 37, 38, 39+, 48+, 53, 54+, 64+, 66, 67+, 127+, 184+, 199+, 253.1+, 274+, 292, 293+, 324+, 342.1+, 343+, for processes of tube making or reshaping by the use of various named types of apparatus.
- 368 Making:**
This subclass is indented under subclass 367.1. Process which relates to the manufacture of a tube and in which the blank or material subjected to the deforming operation has a shape other than a tube immediately prior to such operation.
- 369 Bending:**
This subclass is indented under subclass 367.1. Process for changing the direction of the running length of a tube.
- 370.01 Comprising use of internal tool:**
This subclass is indented under subclass 367.1. Process including the use of an active or passive tool located within the interior of the work during the reshaping operation.
- (1) Note. A passive or undriven tool is commonly termed an anvil, a core, or a mandrel.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
57+, for a process involving the use of fluent material as a core or passive tool (e.g., liquid, sand, shot).
96+, 113, 139, 142+, 148, 150, 193, 208+, 264+, 283, and 352+, for a process

- involving the use of an internal tool in a metal-deforming operation employing a specified type of apparatus.
398, for apparatus comprising a floating mandrel.
- 370.02 End necked down:**
This subclass is indented under subclass 370.01. Process which reduces the transverse dimension of an axial extremity of the tube*.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
85, for a process of necking down using a rotating tool to traverse a rotating tube.
370.1+, for a process of end forming without the use of an internal tool.
- 370.03 End upset:**
This subclass is indented under subclass 370.01. Process wherein an axially forced die causes an increase in wall thickness of an axial extremity of the tube*.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
370.1+, for a process of end forming without the use of an internal tool.
- 370.04 Laterally pressed die(s):**
This subclass is indented under subclass 370.01. Process wherein at least one die* is transversely forced against the tube*.
- 370.05 Collapsible mandrel:**
This subclass is indented under subclass 370.04. Process in which the internal tool is undriven and breaks down for removal from the interior of the tube* after the deformation process.
- 370.06 Expanding tube:**
This subclass is indented under subclass 370.01. Process in which the transverse dimension of the tube* is increased.
- 370.07 Sleeve expanded in passage:**
This subclass is indented under subclass 370.06. Process in which a tube* is deformed outwardly to engage the inner wall of a hole.
- 370.08 Expanding internal tool:**
This subclass is indented under subclass 370.06. Process in which the tool in the interior of the tube* increases in size transversely thereby deforming the tube*.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
393, for a tool for tube expanding.
- 370.1 End forming:**
This subclass is indented under subclass 367.1. Process in which deformation is directed to an axial extremity of the tube*.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
370.01+, for a process of end forming using an internal tool.
- 370.11 Flange forming:**
This subclass is indented under subclass 370.1. Process in which an axial extremity of the tube* is flared outward making a projecting rim.
- 370.12 End closing (e.g., crimping):**
This subclass is indented under subclass 370.1. Process in which an axial extremity of the tube* is sealed off.
- 370.13 Compression die (e.g., swaging):**
This subclass is indented under subclass 370.1. Process in which an axial extremity of the tube* is shaped using a forced die*.
- 370.14 Changing wall thickness:**
This subclass is indented under subclass 367.1. Process in which the transverse dimension of the tube's* metal* is varied.
- 370.15 Increasing wall thickness:**
This subclass is indented under subclass 370.14. Process in which the transverse dimension of the tube's* metal* is enlarged.
- 370.16 Fin or thread forming:**
This subclass is indented under subclass 367.1. Process in which ribs are made on a surface of the tube*.

370.17 Internal:

This subclass is indented under subclass 370.16. Process in which ribs are made on the tube's* inner surface.

370.18 And external:

This subclass is indented under subclass 370.17. Process in which additional ribs are made on the tube's* outer surface.

370.19 Corrugations forming:

This subclass is indented under subclass 367.1. Process in which the tube's* wall is bent making ridges and troughs.

370.2 Axial:

This subclass is indented under subclass 370.19. Process in which the ridges and troughs are oriented parallel to the tube's* axis.

370.21 Groove forming:

This subclass is indented under subclass 367.1. Process in which a channel is made on a surface of the tube*.

370.22 Using pressurized fluid during deformation:

This subclass is indented under subclass 367.1. Process in which a liquid or a gas at a pressure other than the ambient pressure is used while shaping.

370.23 Change in cross section:

This subclass is indented under subclass 367.1. Process in which the tube's profile is dimensionally modified.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

370.01+, for a process of changing the cross section using an internal tool.

370.24 Change in circular tube diameter:

This subclass is indented under subclass 370.23. Process wherein the tube* has an annular profile which is modified by varying the transverse dimension of the annular profile.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

370.06+, for a process of expanding a circular tube using an internal tool.

370.25 Reduction in diameter:

This subclass is indented under subclass 370.24. Process in which the transverse dimension of the annular profile is decreased.

370.26 Polygon cross section (e.g., rectangular):

This subclass is indented under subclass 370.23. Process in which the tube* is deformed to produce a profile having three or more straight adjoining sides.

370.27 Forming holes in tube:

This subclass is indented under subclass 367.1. Process in which an opening is formed in the tube's* wall.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

324+, for a process of cutting a tube.

371 Coiling and/or twisting:

This subclass is indented under subclass 362. Process including a step of convoluting work material through more than 360° into a self-sustaining spiral winding, e.g., an involute or a helix, and/or deforming the workpiece by changing the relative angular orientation of two next adjacent portions about an internal axis passing through both.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

64+, for twisting axially moving work.

66+, for coiling work by use of a work guide member which orbits about the longitudinal centerline of the formed coil.

127+, for coiling by deflecting successively presented portion of work during bodily movement thereof.

299, for twisting work by and between relatively pivoted clamps.

372 Involving use of claimed apparatus:

This subclass is indented under subclass 362. Process which includes a step of using a claimed structural instrumentality or portion thereof (not classifiable in any subclass above 362) for engaging and/or applying force to work to deform it in carrying out the claimed process.

- (1) Note. The structural instrumentality may be named as a whole or defined by the recitation of sufficient parts or attributes thereof to enable its identification as metal-deforming apparatus. Thus, claimed recitation of a tool couple, a single deforming tool, or a surface or shape which must necessarily be attributed to a tool will place a patent in this or an indented subclass. Process terms which express or imply specific apparatus, such as, for example, in the underlined expressions below, are appropriate for this subclass: die express, die shape, drop forge, hammer swage, force between surfaces. Examples of process terms which do not denote apparatus limitations for this subclass are: Reduce, enlarge, shape, form, draw, forge, bend, stretch, upset, work, swage. These are manipulative steps capable of accomplishment manually or by unspecified types of apparatus. Search any appropriate subclass above for a process for carrying out an operation classified in such subclass.

373 Reciprocating tool:

This subclass is indented under subclass 372. Process using a work-engaging deforming or shaping tool which travels in a rectilinear operational path to and from the work.

374 Opposed tool faces:

This subclass is indented under subclass 373. Process using apparatus in which the face of the reciprocating tool is directly opposed through the work and in the line of reciprocation by another tool means, i.e., the tools have confronting work-engaging deforming face areas which would collide if unrestrained.

SEE OR SEARCH THIS CLASS, SUBCLASS:

394+, and any following subclass, for an opposed face tool couple device which may be utilized in a method of this subclass.

375 Complementary:

This subclass is indented under subclass 374. Process using apparatus which includes opposed shaping tools whose work-engaging

surfaces are generally of similar and mating or interdigitating form (allowing for the thickness of the work), so that a shape product corresponding to the tool shape and of generally uniform thickness results.

- (1) Note. The patents found here are mainly directed to shaping (e.g., embossing) sheet metal.

SEE OR SEARCH THIS CLASS, SUBCLASS:

414+, for apparatus comprising complementary tool faces.

475, for a complementary-faced tool couple, per se.

376 Single tool pair:

This subclass is indented under subclass 374. Process in which work is deformed by a single opposed face tool couple* consisting simply of two relatively movable members.

SEE OR SEARCH THIS CLASS, SUBCLASS:

404+, for metal-deforming mechanism comprising a plurality of single tool couples.

407, and appropriate subclasses therebelow, for apparatus in which the invention lies in metal-deforming mechanism which is limited to a single tool couple.

377 With attenuation, thickening elongating shortening of work material:

This subclass is indented under subclass 362. Process including a step which causes a plastic flow of work material which in turn results in a reduction or an enlargement of any dimension of the work material not compensated for by a parallel and opposite flow.

- (1) Note. The subject matter of this subclass relates to substantially all metal-deforming operations except "bending".

SEE OR SEARCH THIS CLASS, SUBCLASS:

372.2+, for a metal-deforming process characterized by a bending step.

378 By application of tensile forces:

This subclass is indented under subclass 377. Process in which work material is deformed by subjecting it to tension, as by stretching or drawing.

SEE OR SEARCH THIS CLASS, SUBCLASS:

274+, for stretching work by pulling it through a closed periphery die, e.g., wire-drawing.

302+, for stretching work by opposed relative translatory motion of plural work-gripping clamps.

347+, for stretching work by pushing a portion of it through a closed die (e.g., drawing).

379.2 Deforming sheet metal:

This subclass is indented under subclass 362. Process, not classifiable in any other subclass thereunder, for deforming work material which is substantially two-dimensional in nature, i.e., having length and width dimensions which are extremely large as compared to the general thickness of the material.

- (1) Note. This subclass is residual to sheet material deforming processes. Search for a process of deforming sheet material must therefore be extended to any other subclass above in this schedule which may be appropriate to sheet metal deformation, e.g., subclasses 179, 196, or 375.

379.4 Container making:

This subclass is indented under subclass 379.2. Process including a step of creating a vessel for holding material therein.

379.6 Forming undulations:

This subclass is indented under subclass 379.2. Process including a step of creating a sinuous configuration in the surface(s) of the two dimensional material including creation of at least two "peaks" and at least two "valleys".

380 BY RELATIVELY MOVABLE OFFSET TOOL FACES (E.G., FOR BENDING OR DRAWING):

This subclass is indented under the class definition. Device comprising means to drive or guide one or more tools* in such relationship to

a coating tool that the tool faces of all said tools are movable freely past each other without interfering contact, to effect a disclosed deforming operation.

- (1) Note. Subclasses 380+ is intended to accommodate all disclosures of apparatus of the offset-tool-face type, not classifiable in preceding subclasses, and having two or more metal-deforming tools (e.g., hammer and anvil, die and work-pusher, coating forming blocks or dies, etc.), which tools are disclosed as being relatively movable toward, or toward and past each other, with a noninterfering stroke (i.e., no interference between actual work-engaging tool portions, or tool-faces*), thereby accomplishing such operations as bending, flanging, drawing, and others which do not involve the direct compression of work between confronting tool-faces, and in whose operation there is always to be found an increase in some dimension of the work.
- (2) Note. The definition of this subclass excludes a tool couple having any face portions (i.e., work-engaging portions) in directly opposed relationship. Such a device constitutes an opposed-face tool couple for placement in succeeding subclasses, e.g., subclasses 412+, for nonplanar tool-face.
- (3) Note. The combination of devices having offset-face and opposed-face tool couples, or plural offset-face couples, is classifiable in subclass 384. See (1) Note under subclass 384 for criteria applicable to plural or combined offset-face devices.
- (4) Note. The shape of the tools is not always an adequate criterion for placement of a disclosure in subclasses 380+; for example, a press with flat-faced ram and anvil block may actually be disclosed only for use in partially straightening a bent or V- or W-shaped workpiece, in which case the tool-faces* (only those portions of the flat surfaces of the ram and block which engage the work during the disclosed operation)

may be “offset” for subclasses 380+; the same press, if claimed for flattening a crumpled plate, would be classified in a lower subclass, possibly in subclasses 429+, for the reason that flat and opposed-face tool couples are of too general application for placement, as such, in any specific subclass in this schedule.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

293+, and particularly subclasses 296+, 298+, 301, 305, and 319+ for relatively movable work-gripping clamps, or clamp and tool, many of which arrangements may constitute, in effect, offset face tool couples.

347+, for cup or shell-drawing apparatus comprising the combination of annular and circular offset tool faces.

457+, for a work-constrainer and/or manipulated work-forcer device, which may be usable for bending or other offset tool face operations.

381 Embodying three or more co-acting relatively movable tools (i.e., tool complex):

This subclass is indented under subclass 380. Device which comprises a first and a second movable tool and a co-acting tool and means to move or guide said second movable tool into engagement with work along a different path and/or at a different time with respect to said first movable tool, in such manner that all said tools are in simultaneous contact with the same work at some instant during an operation of the class type.

- (1) Note. This subclass relates to a tool complex*, which is distinguishable from a tool couple* by the presence and coaction of a third tool, and is distinguishable from plural tool couples (subclasses 384, and 404) by the condition that three or more tools are concurrently in contact with the same workpiece at some instant during the deforming operation. A tool-complex generally effect more elaborate or more extensive deformation than could be accomplished by the sequential action of plural tool couples.

- (2) Note. The “second movable tool” of the above subclass definition may be (a) a distinct tool element, or (b) a yieldable or yieldably-mounted portion of the face of the first-named tool; in either case, the additional tool element or face portion must have motion relative to the first-named tool during the deforming operation. (The additional tool need not act as an offset face tool).

- (3) Note. It is possible for a combination to meet the definition of this subclass even though the movable tools are located at different tool stations, (as in a progressive punch press), provided that they concurrently engage integrally connected portions of the same work material (e.g., prior to the severance of discrete blanks or products from a strip).

- (4) Note. Many combinations in preceding subclasses constitute tool complexes; a full search would therefore include subclasses 67+, Rotating or gyrating tool; 127+, Deflecting bodily moving work; 184+, Flying tool; 199+, Rolling; 278+, Wire drawing with plural tools; 293+, Work-clamp and relatively movable clamp, tool, or work forcer; and 343+, Closed die apparatus.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

67+, 127+, 184+, 199+, and 278+ (and particularly subclasses indented thereunder whose titles indicate the presence of three or more tools) for a tool complex arrangement is a specialized environment.

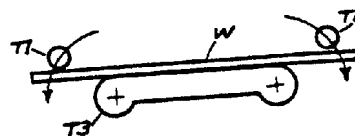
293+, particularly 296+ and 309 for tool complex wherein one or more of the tool elements has the form of a clamp.

348+, 350+ and 353.2+, for closed-die apparatus involving three or more relatively movable tools.

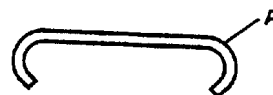
393, for three or more relatively receding tools.

394+, for three or more relatively movable opposed-face tools.

382 This subclass is indented under subclass 381. Comprising yieldable tool or face portion: Device wherein the face of one of said tools is so constructed, mounted, or connected to an actuating power train, that during a metal-deforming operation a portion of said face, while in contact with work, is deflected or bodily displaced with respect to another portion of said face.



- (1) Note. A device of this subclass typically comprises a tool couple, one element of which has resiliently constructed or resiliently mounted face portion (i.e., less than the entire tool face) which yields upon forcible contact with work during deformation by said face, thus moving with respect to another face portion of the same tool and so modifying the effect of a simple tool couple.
- (2) Note. A second included type device employs a “floating”, yieldable, or shiftable mandrel, core, or the like interposed between two portions of work which are acted upon by a tool couple.



Offset-face tool-complex concurrently actuated tools (subclass 383).

SEE OR SEARCH THIS CLASS, SUBCLASS:

353.2+, for concurrently actuated tools in closed die apparatus.

399+, for concurrently actuated tools in opposed-face relationship.

SEE OR SEARCH THIS CLASS, SUBCLASS:

396+, for a yieldable face portion or auxiliary tool in opposed-face-complex

465.1+, for a flexible or yieldable tool.

383 With concurrent actuation of tools:

This subclass is indented under subclass 381. Apparatus comprising a force-transmitting power train connected to the moving means of each of the movable tools, effective to drive said movable tools generally simultaneously during an operation of the class type.

- (1) Note. The movable tools need not be actuated exactly in synchronism to meet the definition of this subclass; their cycles of actuation should at least overlap, to distinguish from the tools of subclass 381, which are sequentially driven (or are intended to be manipulated one at a time and left in work-engaging position).

384

Plural:

This subclass is indented under subclass 380. Device comprising additional organized apparatus which is capable of effecting an operation of the class type.

- (1) Note. The additional apparatus may be complete, per se; or, may be so combined with apparatus of the subclass 380 type as to constitute less than a tool-complex* for subclasses 381+, e.g., tools carried by the same movable ram arranged to perform successive operations upon blanks fed along the bed of a multi-tool station punch press.
- (2) Note. Some examples of offset-face tool-couple combined with other metal-deforming apparatus may be found in preceding subclass areas devoted to specific types of deforming.

SEE OR SEARCH THIS CLASS, SUBCLASS:

404+, for a plural-tool-couple*, in general.

385 Multipoint tool couple (e.g., corrugator):

This subclass is indented under subclass 380. Device wherein each of said plurality of relatively movable tools comprises two or more distinct and spaced work-engaging face portions.

- (1) Note. A device of this subclass type usually impresses two or more bends or twists in one operation on a workpiece; some shaft straighteners are included.

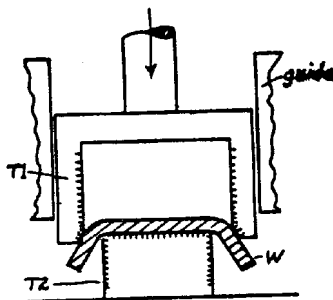
SEE OR SEARCH THIS CLASS, SUBCLASS:

- 412+, for metal-deforming apparatus embodying at least one nonplanar tool face.
474+, for a tool couple with nonsymmetrical faces.

386 With tool motion in fixed path:

This subclass is indented under subclass 380. Device wherein the means to move or guide said movable tool is effective to restrict the motion of said tool to the same path during all operations of the class type.

- (1) Note. A device employing a freely movable sling suspended and pulled by block and tackle (e.g., for bending a large pipe) would be excluded from this subclass, for the actual path of movement of the sling would vary in accordance with characteristics of the workpiece, pulling force, etc. (See subclass 380 for a device of this kind).
- (2) Note. The accompanying diagram illustrates the essentials of a device for subclass 386.



Offset-face tool-couple (actual tool-faces are indicated by shading) (subclass 386).

387 Pivotal motion only:

This subclass is indented under subclass 386. Device wherein said moving or guiding means restrains tool motion to rotation about a fixed axis.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 67+, for metal-deforming apparatus employing a rotary or gyratory tool.
216+, for metal-deforming apparatus embodying one or more work-engaging rollers swingable about a fixed pivot.
298+, for metal deformation by two work-gripping clamps having relative pivotal motion.
310, and 319+, for metal deformation by clamp and coacting tool with relative pivotal motion.

388 Cantilever bender:

This subclass is indented under subclass 387. Device wherein the work-engaging face portion(s) of one relatively movable tool is disposed at a greater radial distance from said fixed axis than the work-engaging face portion(s) of the other tool.

- (1) Note. A typical device of this subclass bends the unsupported projecting end portion of a rod or pipe into arcuate shape by the travel of a sweep-arm-carried tool along the outer side of the work, while another portion of the work is restrained in a groove or socket, or by spaced face portions, of a fixed tool element.
- (2) Note. Similar apparatus may be found in subclasses 319+ where the work is held in a (per se) nondeforming clamp; and in subclass 310 where the work-clamp is pivoted.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 217+, for a sweep-arm bender comprising a work-engaging roller instead of a sliding shoe as the pivoted bending tool.

389.1 Between and co-planar with opposed tools:

This subclass is indented under subclass 386. Device including a first tool and an opposing second tool in which the first tool has a single tool-face* and the second tool has two contraposed tool-faces which lie in a plane which is parallel to the single tool-face, wherein the single tool-face passes between the contraposed tool faces to deform a workpiece thereon.

- (1) Note. This and the following indented subclasses comprise the locus for placement of patents to shaft straighteners which embody an actuated ram, and adjustable positionable V-blacks or the like on fixed bed.

389.2 For a small radius bend:

This subclass is indented under subclass 389.1. Device particularly adapted to deform a workpiece such that the radius of curvature on the inside surface of the workpiece approaches zero.

389.3 Elongated knife edge die (i.e., press brake):

This subclass is indented under subclass 389.2. Device wherein the single tool face is comprised of an elongated ridge parallel to the plane of the contraposed tool-faces, such that, as measured along the ridge the members are much much longer than wide and cooperate to create a sharp straight bend in a planar or sheet-like workpiece.

389.4 Adjustable tool face:

This subclass is indented under subclass 389.3. Press brake wherein the single tool-face or the two contraposed tool faces are specifically designed to be repositioned or reshaped with respect to their support structure.

389.5 Opposed tools having adjustable crown (i.e., provision for die crowning):

This subclass is indented under subclass 389.4. Press brake wherein the two contraposed tool faces are reshaped to compensate for the deflection of the bending mechanism under the force of the single tool face.

389.6 Fluid pressure actuated (i.e., hydraulically or pneumatically actuated):

This subclass is indented under subclass 389.1. Device including a mechanism driven by a gaseous or liquid medium to move one of the tools.

389.7 Manually pumped (e.g., by use of a hydraulic jack):

This subclass is indented under subclass 389.6. Device including a mechanism for transmitting energy to the fluid pressure actuating device directly from the user.

389.8 Pivotal opposed tools:

This subclass is indented under subclass 389.6. Device wherein the two contraposed tool-faces turn about an axis as the workpiece is deformed.

389.9 Rack and pinion actuated:

This subclass is indented under subclass 389.1. Device including a mechanism which converts rotary motion into linear motion using a gear and toothed bar to move one of the tools.

390.2 Ratchet actuated:

This subclass is indented under subclass 389.1. Device including a linearly movable rod which is engaged by a one way locking mechanism and a mechanism which indexably engages the rod for incremental movement to move one of the tools.

390.3 Cam actuated:

This subclass is indented under subclass 389.1. Device including a contoured surface which moves along another surface to move one of the tools.

390.4 Linkage actuated:

This subclass is indented under subclass 389.1. Device including two or more pivotally connected members (links) to move one of the tools.

390.5 Lever actuated:

This subclass is indented under subclass 389.1. Device including an elongated member rotatable about a fulcrum to move one of the tools.

390.6 Screw actuated:

This subclass is indented under subclass 389.1. Device including a screw and nut mechanism to move one of the tools.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 248, for a screw down device in a roller carrier.
- 293+, for many examples of screw-actuated nondeforming work-clamps in metal-deforming apparatus.
- 454, for a screw-actuated tool support.

SEE OR SEARCH CLASS:

- 269, Work Holders, subclasses 240+ for a screw-actuated vise jaw.

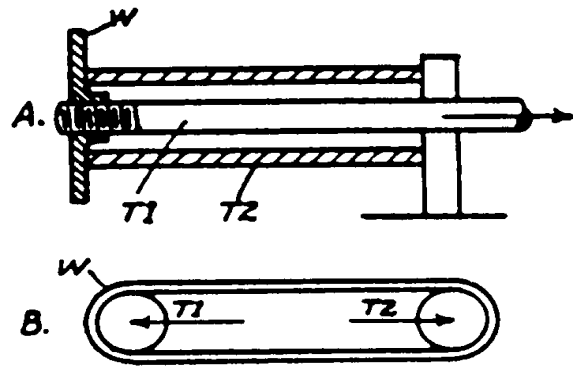
390.7 Puller:

This subclass is indented under subclass 390.6. Device wherein the member connected to the single tool-face is under tension.

391.2 Concentric or telescoped tools:

This subclass is indented under subclass 386. Device wherein the path of motion of said movable tool is a straight line, and the respective work-engaging surface portions (i.e., tool-faces*) of the elements are of substantially annular shape and are radially offset about a common axis aligned with said path of motion.

- (1) Note. A typical device of this subclass is an upsetter for hollow rivets, comprising a headed pulling tool surrounded by a tubular sleeve; a hollow rivet engaged by the head is upset against an annular anvil surface on the end of the sleeve.
- (2) Note. The subject matter of this subclass differs from somewhat similar subject matter in subclass 392, in that the co-acting tool-faces in this subclass (391.2) are radially offset, i.e., they move in noninterfering paths, while the stretching tool-faces of subclass 392 move (in opposite directions) along the same path. (see appended diagram): (A) Work engaged by radially offset tool-faces (subclasses 391.2+); (B) Work engaged by receding, in-line, tool-faces (subclass 392).



SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 274+, for metal-deforming apparatus comprising a gripper capable of pulling elongated work through a die orifice.
- 347+, for deep drawing apparatus comprising radially offset concentric tool faces.

391.4 Tool inside hollow fastener:

This subclass is indented under subclass 391.2. Device wherein a first tool engages an annular end surface of a tube-like workpiece, which surface generally faces the device, which tool includes a passageway coaxial with the tubular axis of the workpiece, and wherein a second tool extends through the passageway of the first tool and through at least a portion of the interior of the tube-like workpiece and engages the workpiece to deform the workpiece by movement relative to the first tool.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 243.518 for metal deforming by a tool inside a hollow workpiece to effect assembly by overedge bending wherein two workpieces are engaged (recognized) for relative movement or relative securement; and subclasses 243.519+ for a device including a tool that engages a tubular member and a member inside that tubular member to relatively move the members and effect repositioning and deformation thereof, particularly subclasses 243.521+ for a driver for a snap-off-mandrel fastener.

391.6 With fastener loader or supply:

This subclass is indented under subclass 391.4. Device combined with (1) structure to place a new fastener for engagement by the tools or (2) with means to store plural fasteners.

SEE OR SEARCH CLASS:

29, Metal Working, subclass 812.5 for a driver for snap-off-mandrel fastener having a fastener magazine.

391.8 Helically ribbed tool:

This subclass is indented under subclass 391.4. Device wherein the tool passing at least through a portion of the workpiece is screw threaded along its axis and is intended to screw fit with a cooperating mating surface of the workpiece.

- (1) Note. The tool of this subclass is brought into engagement with the workpiece by relative rotation therewith, however deformation is effected by straight line movement of the tool with respect to the work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

114, for similar structure wherein deformation of the workpiece is effected by the action of the tool while turning about its axis with respect the workpiece.

392 BY RELATIVELY RECEDING WORK-ENGAGING TOOL FACES (E.G., FOR STRETCHING):

This subclass is indented under the class definition. Device comprising a plurality of distinct tools each having at least one tool-face* and means to move or to guide the motion of one of said tools relative to another tool along a predetermined path in such direction that the distance between the tool-faces generally increases from an initial minimum spacing throughout an operation of the class type.

- (1) Note. The tools may be pegs or lugs which engage in apertures in the work or in the interior of ring-shaped or U-shaped work, and which move apart to stretch the work, either locally or as a

whole, usually involving a major change of shape of a specific workpiece.

- (2) Note. For tools which move generally toward and past each other without tool-face conflict, while deforming work, see subclasses 380+, above.
- (3) Note. For devices having concentric receding tool faces which stretch work (such as the mandrel of a "Huck" rivet), see subclasses 391.2+; these tool faces are radially offset, rather than directly opposed in the direction of tool motion. The distinction is illustrated in Figures A and B of the diagram accompanying subclasses 391.2+.
- (4) Note. This subclass includes disclosures of devices, such as a tire-stretcher, which comprise a split ring and means to expand it; the effect is substantially that of distinct receding tool-faces.

393 Embodying three or more tools (e.g., tube expander):

This subclass is indented under subclass 392. Device wherein two or more of said tools are movable with respect to another said tool.

- (1) Note. For example, the device of this subclass may comprise three or more segmental tools expansible by means of a central wedge to flare the end portion of a tube or other hollow work.
- (2) Note. A similar arrangement of expansible tools, but acting within a closed-die, would be placed in subclasses 353.4+ if the outer die structure consisted of spaced tools, the combination would be placed in subclasses 400+ (opposed face tool-complex).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

58+, and 61+, for expansion of hollow work by pressurized fluent material.

120+, for metal deformation by radial outward motion of the tool elements of a rotating tool assembly.

355.2+, for a metal deformation by wedge-actuated, symmetrically expanding tools within a closed-die.

370.01+, for a process of tube reshaping by the use of an internal tool.

400+, for metal-deforming apparatus comprising two or more radially movable tools with coacting fixed tool, and see (2) Note, above.

394 BY THREE OR MORE COACTING RELATIVELY MOVABLE TOOLS (I.E., TOOL COMPLEX):

This subclass is indented under the class definition. Device comprising a plurality of tools each having a face portion which is designed and intended to engage work with deforming force at some time during an operation of the class type, and means to move or to guide the motion of at least two of said tools (or distinct face portions of one flexible tool) into engagement with work along different paths and/or at different times or with different velocities with respect to each other and to another such tool, in such manner that all said tool face portions are in simultaneous contact with the same work at some instant during said operation.

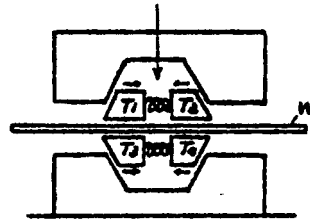
- (1) Note. This subclass relates to a tool-complex*, which is distinguishable from a plural-tool-couple* by the condition that, in the operation of the former, all tools are concurrently in contact with the same workpiece at some instant during the operations. (See (1) through (4) Notes under subclass 381, which apply as well to this subclass 394).
- (2) Note. The subclasses indented under subclass 394 generally involve concurrently movable tools; devices wherein tools are successively applied to work, as by a manipulative routine, are found in this subclass (394).
- (3) Note. To complete the field of search for tool-complex*, see the search notes under subclass 381.

395 With paired coplanar tool faces for stretching flat work:

This subclass is indented under subclass 394. Device wherein at least two of said relatively movable tools have substantially flat work-engaging surfaces and said tool-moving or guiding means is effective to maintain said sur-

faces approximately in alignment with each other.

- (1) Note. Typical of this subclass is a device having two pairs of opposed-face tools arranged to pinch work therebetween usually with an impact blow, and to thereupon move toward or away from each other while holding work, to impart upsetting or stretching force to the region of work between the pinched portions. See accompanying diagram.



Tool-complex with paired, coplanar tool-faces, arranged to upset flat work (subclass 395).

- (2) Note. The tools generally have a hammering or peening effect which distinguishes them from the nondeforming work clamps of subclasses 293+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 302+, for means or method of deforming metal by utilizing spaced, relatively movable work-gripping clamps arranged to upset or to stretch intervening portions of work.
- 392+, for apparatus comprising directly receding tool-faces for stretching work.
- 396+, and 399+, for similar apparatus not restricted to coplanar paired tool-faces.

396 Yieldable face portion or auxiliary tool on tool couple element:

This subclass is indented under subclass 394. Device wherein said movable work-engaging face portions are constituted by relatively distortable or displaceable parts of the work-engaging surface portion of one of said tools, or by a distinct relatively displaceable work-engaging member carrier by or associated with

one of said tools, such that during an operation of the class type said relatively distortable or displaceable part or member, while in engagement with work, is distorted or bodily displaced with respect to its associated tool.

- (1) Note. A device of this subclass typically comprises an opposed-face tool couple wherein one or both of the tools carries a resilient mounted auxiliary tool, or has a differentially yieldable (e.g., elastic) face portion, thus modifying the effect obtainable with a simple tool couple.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 382, for metal-deforming apparatus comprising a yieldable tool or face-portion on a tool element of an offset-tool-couple.

397 On actuated tool:

This subclass is indented under subclass 396. Device wherein said relatively distortable or displaceable part or said distinct member is attached to or mounted on a driven element of a tool couple.

- (1) Note. The yieldable tool or face portion is thus driven by or with the active tool of a tool couple (see Figure B of the diagram accompanying subclass 398).
- (2) Note. For an indirectly driven tool (i.e., moved against work by force derived from another portion of the work), see the floating mandrel combination in subclass 398, below. A floating mandrel is an active tool, although indirectly driven. Compare the passive indirectly driven tools of subclass 396 above.
- (3) Note. The yieldable tool or member may constitute a "blank-holder" for frictionally restraining movement of work during deformation by a tool couple. Any disclosure of work slippage or flow relative to a blank-holder or restraining element bars the combination from placement in the nondeforming work-gripping clamp area, see subclasses 293+.

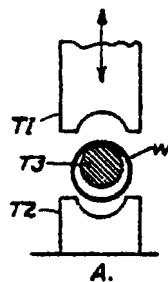
SEE OR SEARCH THIS CLASS, SUBCLASS:

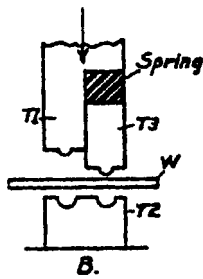
- 293+, for a positively gripping, nondeforming clamp element associated with a driven tool.
- 350+, for a yieldable blank-holder associated with a cup- or shell-drawing device.
- 465.1+, for flexible or yieldable tool structure

398 Movable toward and against portion of work (e.g., floating mandrel):

This subclass is indented under subclass 396. Device wherein said relatively distortable or displaceable part or said distinct member is disposed and arranged to be driven into deforming contact with work by the reaction force derived from the displacement of another portion of work undergoing deformation.

- (1) Note. The yieldable tool in this subclass is thus both in active and a passive tool; it takes reaction force from a portion of work and transfers it to another portion of work.
- (2) Note. Typical of this subclass is a "floating mandrel" which lies within hollow work while the latter is being subjected to external hammering or pressing treatment by an opposed-face tool couple. The mandrel may serve merely to maintain the interior dimension of the work or it may permit and limit a redimensioning of the interior. (See Figure A of the appended diagram). Examples of tool complex devices: A. Floating mandrel (subclass 398); B. Yieldable auxiliary tool (T3) on actuated tool (T1) (subclass 397).





- (3) Note. This subclass also accommodates the combination of one or more tools (dies or mere platens) interposed between successive layers of stacked workpieces in a press.

399 **Concurrently actuated tools:**

This subclass is indented under subclass 394. Device comprising means so interconnecting the tool-moving or -guiding means as to cause or assure simultaneous movement of the movable tools.

- (1) Note. The tools are not required to be moved in exact synchronism to meet the definition of this subclass; but their cycles of motion must overlap, to distinguish from the sequentially driven or manipulated tools of subclass 403.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 75, 76, 88+, and 119, for metal deformation by concurrently actuated rotating or gyrating tools.
 187+, for metal deformation by concurrent actuation of "flying" tools.
 199+, for a closed-die tool-complex with concurrently actuated tools.
 353.2+, for a closed-die tool-complex with concurrently actuated tools.
 383, for concurrently actuated tools in an offset-face tool-complex.
 393, for concurrently actuated receding tools (e.g., for stretching or flaring work).

400 **With co-acting fixed tool:**

This subclass is indented under subclass 399. Device comprising a passive (i.e., nondriven) work-engaging tool designed and intended to

oppose displacement of work which is subjected to deforming force by said movable tools.

- (1) Note. The fixed tool may be, for example, a rigid mandrel for supporting the end of a pipe being swaged between opposing hammers. For a yieldable mounted mandrel see subclass 398 above. For an anvil with a yieldable portion see subclass 396.
- (2) Note. This and indented subclasses are not limited to devices for treating hollow work; the fixed tool may be, for example, a forming block against which a bar or sheet is forged or bent by two or more concurrently actuated tools.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 398, for a loose or yieldably-mounted mandrel between the tools or an opposed-face tool couple.

401 **Between generally opposed stroke tools:**

This subclass is indented under subclass 400. Device wherein two or more of said movable tools are arranged to approach said passive tool simultaneously from substantially opposite directions.

- (1) Note. The term "substantially opposite directions" is intended to include directions which afford cancellation or balancing out of much of their resultant forces on the work and the fixed tool.

Evidence of this effect may be found in disclosure of light-weight construction, ease of holding the work, rapidity of operation, etc.

402 **All tools moveable radially inward:**

This subclass is indented under subclass 399. Device comprising means to guide all the actuated tools for motion in the direction of a common point of convergence while said tools are deforming work.

- (1) Note. A typical device for this subclass is a rod or tube swagger with multiple hammers.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 76, for a multiple-hammer swaging device with rotatable work or tool assembly.
- 121, for a metal-deforming device having rotation and radially inwardly moving tools.
- 404, for a swaging device having sequentially actuated tool-couples.
- 408, for a swaging device having only two opposed hammers.

403 With means to actuate tools in sequence:

This subclass is indented under subclass 394. Device, not provided for in preceding subclasses, comprising force-transmitting drive trains for the two or more movable tools, said drive trains being so interrelated that one tool after another is forcibly driven into engagement with work and caused or permitted to remain in such engagement during an operation of the class type.

- (1) Note. A device in which tools are to be successively applied to work by an operative following a manipulative routine may be found in subclass 394. For subclass 403, interrelated tool drive means is required. An interlock device for releasing tools only in a predetermined sequence would be regarded as constituting such interrelationship.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 404+, for plural tool-couples, actuated and retracted in sequence.

404 BY PLURAL TOOL COUPLES:

This subclass is indented under the class definition. Apparatus, not provided for in a preceding subclass, and comprising two or more tool-couples.

- (1) Note. The apparatus may constitute plural devices, each of which is complete, per se, (e.g., two machines side by side or in tandem), or the devices may have parts in common (e.g., the arrangement of two hammers alternately engaging work lying on an anvil), but in any case the combination should fall short of con-

stituting a tool-complex* for subclasses 381 and 394.

- (2) Note. A patent to a multi-tool station or progressive punch press may be placeable as an original copy in this subclass, whether it treats discrete blanks or a continuous strip of stock material. If integral work material extends under a plurality of tools which do not have identical motions but which engage the material simultaneously, the combination may be placeable as a tool-complex* in the above noted subclasses.
- (3) Note. This is the residual locus for the combination of two or more metal-deforming devices. To complete the search on such combinations, see all preceding subclasses which refer to plural operations or to different types of metal deformation; in the preceding subclasses, one operation or type of apparatus will be of a specified description (e.g., subclass 348, cup or shell drawing with additional metal deformation).

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 68, for the combination of rotating or gyrating tool apparatus with other metal-deforming apparatus.
- 130, 137, 152, 161, 168, and 177, for a combined operation including metal deformation by deflecting bodily moving work.
- 187, 221, 256, 278+, 306+, 348+, 356, and 384, for a combined operation including one specified type. (See (3) Note Above.)

405.01 With means to feed work between plural tool stations:

This subclass is indented under subclass 404. Device including a first tool-couple* for deforming work, including a second tool-couple for subsequently deforming the same work, wherein the first and second tool-couples are located in spaced relationship, combined with an actuable instrumentality for advancing work away from the region of effectiveness of the first tool-couple and into the region of effectiveness of the second tool-couple.

- (1) Note. See section VII, A of this class for search references to other classes involving material handling.
- (2) Note. See the search notes under subclass 404 above for combinations of metal-deforming apparatus which are likely to include work feeding.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 324+, for metal deforming combined with cutting and with a means to advance the work from one operation to the other.
- 419+, for a metal deforming means combined with means to handle work or product, generally.

SEE OR SEARCH CLASS:

- 901, Robots, subcollection 6+ for a robot for feeding work between plural tool stations.

405.02 Belt or chain work carrier:

This subclass is indented under subclass 405.01. Device wherein the means to advance work between tool-couples comprises either a flexible elongated strap or a series of links journaled to one another.

405.03 Rotary work carrier (e.g. Turret):

This subclass is indented under subclass 405.01. Device wherein the means to advance work includes an angularly displaceable member which moves the work between angularly spaced tool-couples.

405.04 Threaded rod work carrier:

This subclass is indented under subclass 405.01. Device wherein the means to advance work includes a helically grooved shaft which draws the work or work holder between the tool-couples.

405.05 Sliding table work carrier:

This subclass is indented under subclass 405.01. Device wherein the means to advance work includes a work supporting platform which glides between the tool-couples.

405.06 Continuous stock feed:

This subclass is indented under subclass 405.01. Device wherein the means to advance work between tool-couples consists of means for advancing long work without engaging more than one end of the work.

405.07 Work pushed between tool stations:

This subclass is indented under subclass 405.01. Device wherein the means to advance work between tool-couples includes a mechanism to shove the work from tool-couple to another.

405.08 Including means to store work:

This subclass is indented under subclass 405.01. Device wherein the means to advance work between tool couples includes structure for retaining the work for an indefinite period of time.

405.09 Work grasping:

This subclass is indented under subclass 405.01. Device including a mechanism which physically grips the work.

405.1 Suction device (e.g., suction cup):

This subclass is indented under subclass 405.09. Device including structure to apply a vacuum to grip the work.

405.11 Reciprocating work feeder:

This subclass is indented under subclass 405.09. Device wherein the means to advance work between tool couples moves back and forth between the tool couples.

405.12 Having work grasping jaws:

This subclass is indented under subclass 405.11. Device including a pair of angularly movable pincers which grip the work.

405.13 Adapted to grasp work laterally (e.g., by gripper rail or transfer fingers):

This subclass is indented under subclass 405.11. Device including means to grip the work perpendicularly to the direction of the work feed.

405.14 Telescoping work gripper:

This subclass is indented under subclass 405.13. Device including a work gripper intended to move in and out of an internal passage.

405.15 Rotational movement:

This subclass is indented under subclass 405.13. Device wherein the work gripper has an component of angular motion.

405.16 Lifting movement:

This subclass is indented under subclass 405.13. Device wherein the work gripper is moved to lift the work against the force of gravity.

- (1) Note. Included herein are patents to a device for applying a clip to the snout of a swine regardless of the clip structure.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 700+ for means to assemble or disassemble work pieces together which recognize more than one work piece.
- 81, Tools, subclasses 300+ for plier type tools, generally.

406 WITH MEANS TO EFFECT COMPOUND MOTION OF TOOL (E.G., ROCKING):

This subclass is indented under the class definition. Device comprising means to move or guide a tool* in a generally tortuous path (i.e., neither wholly rectilinear nor wholly rotary about a fixed point) during a deforming operation.

- (1) Note. This subclass is the residual locus of any metal-deforming device or portion thereof, not provided for in preceding subclasses, which comprises a tool guided or driven toward its effective position in a nonsimple path; such path may be, for example, a succession of broken line segments or a smooth (but nonarcuate) curve such as a spiral or an ellipse.
- (2) Note. For placement in this subclass, the device must comprise means to cause the tool to depart from simple rectilinear or circular motion; e.g., if the tool is merely

deflected from an otherwise simple path by the resistance of work, whether this be an intended or unintended condition of operation, the combination does not meet the terms of the subclass definition.

- (3) Note. This subclass accommodates a “rolling form” which picks up and bends or curls work as it travels thereover; the motion of the effective tool-face* is cycloidal, and the operation does not constitute “rolling” for subclass 199, because the tool-face remains in contact with the deformed work (see ROLLER* in the Glossary of this class).

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 293+, for relatively movable work-clamp and tool.
- 353.2+, 381+, 393, and 394+, for a tool-complex* which may involve nonsimple tool motion.
- 429+, for means to drive a metal-deforming tool, in general.

407 WITH MEANS TO ACTUATE BOTH ELEMENTS OF TOOL COUPLE:

This subclass is indented under the class definition. Device comprising two coaxing tools* and power-transmitting linkage which is effective to move said tools in the performance of a deforming operation.

- (1) Note. The tool-couple found in this and indented subclasses is generally of the opposed-face type. Subclass 407 contains, for example, disclosures of fluid-pressure actuated riveting machines; and subclasses 409.01+ contain plier-type devices.
- (2) Note. Many examples of a metal-deforming tool-couple with both tools actuated, will be found in preceding subclasses directed to specific types of apparatus.

408 By continuously rotating shaft:

This subclass is indented under subclass 407. Device comprising a powered rotary element (e.g., a motor shaft), and means for connecting said power-transmitting linkage to said rotary

element to actuate said tool-couple, without halting the motion of said rotary element.

409.01 Handle actuated (e.g., plier type, etc.):

This subclass is indented under subclass 407. Subject matter comprising a graspable member mechanically coupled to said power transmitting linkage and adapted to transmit manual energy exerted by an operative to said tools.

- (1) Note. This is the residual locus for metal deforming devices of the handle actuated plier type. Similarly actuated devices may be found in preceding subclasses providing for the specific type of operation performed.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 700+ for means to assemble or disassemble work pieces together which recognize more than one work piece.
- 81, Tools, subclasses 300+ for plier type tools, generally.

409.02 Hog ringer:

This subclass is indented under subclass 409.01. Apparatus having structure adapted to deform the end portions of a relatively thick clip (e.g., a staple, etc.) toward each other.

- (1) Note. Included herein are patents to a device for applying a clip to the snout of a swine regardless of the clip structure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 409.05, for a surgical clip applier intended to piercingly secure together adjacent edges of living tissue.

SEE OR SEARCH CLASS:

- 53, Package Making, subclasses 138.2+ for clip or staple appliers intended to close a package.
- 227, Elongated-Member-Driving Apparatus, subclasses 175+ for surgical stapling apparatus having an anvil into which a staple is driven and thereby deformed.
- 606, Surgery, subclass 117 for a device to apply an identification tag directly to an animal and subclasses 142+ for a clip applier for application of a clip to

tissue wherein the clip being applied does not pierce the tissue.

409.03 With supply:

This subclass is indented under subclass 409.02. Subject matter including means to store plural clips.

409.04 With work supply or feed:

This subclass is indented under subclass 409.01. Subject matter including means to store a plurality of work or means to advance the work from a storage position to a position where the work can be deformed by said tools.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 409.15, for apparatus for applying a plurality of belt fastening clips substantially simultaneously.

409.05 Surgical clip:

This subclass is indented under subclass 409.04. Subject matter wherein the work is intended to piercingly retain plural edges of animal tissue in abutting relationship.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 409.02+, for apparatus to deform a clip through the snout of a swine.

SEE OR SEARCH CLASS:

- 227, Elongated-Member-Driving Apparatus, subclasses 175+ for surgical stapling apparatus having an anvil into which a staple is driven and thereby deformed.
- 606, Surgery, subclass 117 for means to apply a marking clip to an animal which does not pierce the tissue and subclasses 142+ for surgical clip appliers for clips which do not pierce the tissue.

409.06 Electrical connector:

This subclass is indented under subclass 409.04. Subject matter wherein the work comprises structure for conducting electrical current and which is crimpable onto a wire capable of conducting electrical current.

409.07 Multiple stroke actuator:

This subclass is indented under subclass 409.01. Subject matter having means for progressively operating said tools in response to plural manipulative cycles of the graspable member by the operative.

409.08 Tool having constant angular orientation:

This subclass is indented under subclass 409.01. Subject matter wherein said tools are relatively translatable with respect to each other in fixed alignment.

- (1) Note. For classification in this subclass the patent must disclose tools which do not rotate with respect to each other.

409.09 Including cam:

This subclass is indented under subclass 409.08. Subject matter wherein said power transmitting linkage includes a member having a profiled surface (i.e., a cam) adapted for sliding or rolling contact with a follower member along said surface so as to relatively displace said follower member in a direction generally normal to said surface.

409.1 Including cam:

This subclass is indented under subclass 409.01. Subject matter wherein said power transmitting linkage includes a member having a profiled surface (i.e., a cam) adapted for sliding or rolling contact with a follower member along said surface so as to relatively displace said follower member in a direction generally normal to said surface.

409.11 Plural tools pivotal with respect to plural handles:

This subclass is indented under subclass 409.01. Subject matter including two graspable members and wherein each of said tools is angularly movable with respect to each graspable member through an articulatable linkage.

409.12 Toggle:

This subclass is indented under subclass 409.01. Subject matter wherein said power transmitting linkage includes two elongate members and a pivotal joint connecting said elongate members together such that a force applied to said joint is converted to a force

tending to change the angle of separation of said elongate members.

- (1) Note. As the angle of separation of the members moves toward 180 degrees the overall dimension of the linkage approaches a maximum. As the angle of separation between said members increases past 180 degrees the linkage is referred to as "locked".

409.13 Including distinct work retaining or positioning means:

This subclass is indented under subclass 409.01. Subject matter including means separate from said tools for supporting or spatially orienting the work with respect to said tools.

409.14 Electrical connector:

This subclass is indented under subclass 409.13. Subject matter wherein the work comprises structure for conducting electrical current and which is crimpable onto a wire capable of conducting electrical current.

409.15 Belt clip:

This subclass is indented under subclass 409.13. Subject matter wherein the work comprises a plurality of fasteners arranged for piercingly attaching two longitudinal ends of a substantially flat flexible elongate member together to form an endless loop.

SEE OR SEARCH CLASS:

- 24, Buckles, Buttons, Clasps, etc., subclasses 31+ for belt fasteners, per se.
474, Endless Belt Power Transmission Systems and Components, for endless belts, per se.

409.16 Including selectable or replaceable tool:

This subclass is indented under subclass 409.01. Subject matter including a plurality of said coating tools alternatively choosable by an operative or means providing for the substitution of one of said tools for another.

- (1) Note. A device having an inherently replaceable tool without specific disclosure to a replaceable tool function is insufficient for classification in this subclass.

409.17 Spreader:

This subclass is indented under subclass 409.01. Subject matter wherein said power transmitting linkage is configured to separate the tools with the energy applied by the operative.

- (1) Note. Many handle operated devices may inherently be used to separate tools under force. For classification in this subclass the device must separate the tools using the energy of the operative as its normal disclosed function.

409.18 Flanger or beader:

This subclass is indented under subclass 409.01. Subject matter wherein said tools are configured to create a lip in the work or to interlock plural edges of one or more articles of work together.

409.19 Work comprises tube:

This subclass is indented under subclass 409.01. Subject matter wherein the work comprises a hollow elongate cylinder.

411 BY RELATIVELY MOVABLE TOOLS HAVING SLIDABLY ENGAGED WORK-CONFINING WALL MEANS (E.G., EDGE-WISE SHEET METAL BENDER):

This subclass is indented under the class definition. Device comprising means to move or guide one tool* with respect to another tool in a generally predetermined path, each said tool comprising a surface or wall portion extending forwardly of the tool-face* and in substantial alignment with the direction of relative motion between said tools, which surfaces or wall portions on coacting tools are laterally offset to accommodate work therebetween, and are each arranged to overlap and engage a lateral surface on the coacting tool during the approach of said tools for a deforming operation.

- (1) Note. A device of this type is frequently employed to perform a bending operation on sheet or thin plate material in the plane of this width, the added wall means on the dies serving to inhibit crumpling or buckling of the thin material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 57+, 127+ and 359, for some examples of work confined but not deformed between slidably-engaged wall portions on tools while being deformed by the tool-faces.
- 701, for distortion preventing means which may comprise laterally spaced walls on tools.

412 BY TOOL COUPLE EMBODYING NON-PLANAR TOOL FACE:

This subclass is indented under the class definition. Device comprising a tool-couple* and means to drive or guide one element of said couple in a predetermined path relative to the other element of said tool-couple to effect an operation of the class type, the tool-face* of at least one such element having a portion of three-dimensional configuration (e.g., grooved, concave, etc.).

- (1) Note. Flat-face tool couples are excluded from this subclass because their functions are varied and nonspecialized. Devices of the patents in this subclass are usually special-purpose machines (e.g., for die forging, for embossing sheet metal, for bending, etc.).
- (2) Note. Metal-deforming apparatus comprising relatively movable tools of specified shape, if not provided for in a preceding subclass, is generally placeable in the subclass or one of its indented subclasses; the tool-couple, per se, is classified in subclasses 470+ and a single tool element in subclasses 462+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 470+, for a tool-couple, per se.

413 With adjustable or replaceable section of tool face:

This subclass is indented under subclass 412. Device comprising structure which is designed and intended to facilitate alteration in size, shape, or position of one portion of the tool-face with respect to another portion thereof, or to facilitate removal of a tool-face portion and substitution of another.

- (1) Note. If a portion of a tool-face should yield or shift significantly during the deforming operation, the combination would constitute a tool-complex* for placement in subclasses 394+ above.
- (2) Note. This subclass does not relate to adjustable or removable mounting means for an entire tool as a unit, for which search subclasses 462+ and appropriate subclasses directed to specified operations.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 93, 140, 157+, 173+, 195, 219, 238+, 260, and 276, for an adjustable or replaceable tool-face or section thereof in various specified metal-deforming devices.
- 353.2+, 382 and 396+, for a yieldable face-portion of a tool.
- 465.1+, for a flexible or yieldable tool or support.
- 478, for a tool having an adjustable or replaceable section.
- 481.1+, for a holder for adjustable or removable tool-face.

414 With complementary tool faces (e.g., for embossing):

This subclass is indented under subclass 412. Device wherein said tool-faces* have substantially equal areas and similar, but reversed, shapes or contours whereby they would be capable of substantially full surface contact (with allowance for the presence of uniform-thickness work therebetween), and including tool-faces which are complementary except for localized work-shape-conforming recesses or projections which have no disclosed deforming function.

- (1) Note. Mating tool faces are regarded as complementary for this subclass even though one or both faces have recesses to receive projections on work, such as rivet heads or ribs, providing there is no deformation of work in these recesses.
- (2) Note. The presence of mere work-positioning ribs, ledges, etc., on otherwise

complementary tool-faces does not bar placement in this subclass.

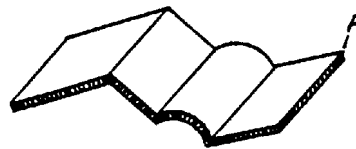
- (3) Note. Grooved pipe-bending dies, for example, are excluded from this subclass for it is evident that deformation takes place in the grooves (the work does not initially fit exactly in the grooves), and the grooves are not complementary.
- (4) Note. A small tool-face may be complementary to an opposed portion of a large tool, anvil, etc., but the combination is barred from this subclass because of their dissimilar areas.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 343+, for closed-die tool couple which may exhibit complementary faces.
- 394+, for opposed-face tool-complex which may exhibit complementary, sectional, tool-faces.
- 475, for a tool-couple with complementary faces.

415 Constant profile (e.g., cylindrical segments):
This subclass is indented under subclass 414. Device wherein cross sections through the mating tool surfaces, taken in planes parallel to any given reference plane intersecting the surfaces, show identical contours.

- (1) Note. The tool face in this subclass have "singly curved" surfaces; they may comprise flat sections, dihedral angles, arcuate, or gee sections, etc., all aligned in the same direction. Such tools effect "simple" angular or contour bending, i.e., without bulging, dishing, or warping of the work surface (see appended diagram).



Product of a tool-couple having complementary faces of constant profile (subclass 415)

- (2) Note. Work-shape-conforming recesses may be present in the tool faces,

with the same restrictions as expressed in the definition and notes of subclass 414.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 319+, for the combination of a nondeforming work-clamp having a die surface extension, and a pivoted tool with complementary die face of constant profile.
- 379.2+, for a process of deforming sheet material which may employ complementary die faces of constant profile.

416 Similar tool faces:

This subclass is indented under subclass 412. Device wherein the tool-faces* have substantially identical shapes.

417 INCLUDING INTERRELATED TOOL MOVER AND BLANK HOLDER MOVER:

This subclass is indented under the class definition. Device including means to move and/or guide two or more relatively movable elements, a portion of the driving and/or guiding means of one movable element having a common connection with the driving and/or guiding means of another one of the movable elements, at least one of said elements being designed and intended to carry a work-engaging instrumentality which (when coupled with an opposing, but not claimed, instrumentality) will hold a portion of the work* during deformation thereof.

- (1) Note. The “movable elements”, as used in the above definition, are frequently denoted as “slides” in patent disclosures.
- (2) Note. See the numerous subclass titles, in the schedule of this class, for expression such as: “clamps(s)”, “tool-complex”, “frictional restraining force”, “gripper(s)”, “interrelated clamp and tool-mover”, “means to hold”, and “work-gripping”, indicating subclasses which include interrelated relatively movable elements that operate in a man-

ner similar to the device defined in this subclass.

418 INCLUDING TOOL MEANS TO MOVE WORK TO OR AGAINST COOPERATING TOOL:

This subclass is indented under the class definition. Apparatus provided with at least two tools acting together to deform work positioned therebetween, wherein one of the tools engages and impels the work bodily through space toward the other tool before the deformation occurs.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 566+ for disclosure of similar structure wherein the tool is a cutter.

419 WITH MEANS TO HANDLING WORK OR PRODUCTS:

This subclass is indented under the class definition. Apparatus provided with means for moving or guiding or affecting the motion of work or product*.

- (1) Note. Various subclasses exist throughout the schedule of this class (72) to provide for a disclosure of a particular type of deformer and a work-handler or product-handler for use with that deformer. The subclass titles will indicate such disclosed subject matter.
- (2) Note. For the lines between this subclass (and those indented hereunder) and classes relating to work handling, see section VII, A of this class.

SEE OR SEARCH CLASS:

- 193, Conveyors, Chutes, Skids, Guides, and Ways, for conveyors, per se.
- 198, Conveyors: Power-Driven, for conveyors, per se.
- 221, Article Dispensing, for an article dispenser, per se.
- 414, Material or Article Handling, for handling, per se.

420 Including means to permit maneuvering of work or product at tool zone:

This subclass is indented under subclass 419. Apparatus provided with means for enabling or facilitating the movement of work that is to be

deformed or that is undergoing deformation, said movement being limited to the environment of the machine area in which deformation occurs.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 249 and 445 for disclosure of similar structure in a cutting machine.
- 198, Conveyors: Power-Driven, subclasses 339.1+ for a conveyor having means for orienting the conveyed load at a work station; and subclasses 373+ for a conveyor having means for changing the attitude of the conveyed load relative to the conveying direction.
- 901, Robots, subcollection 6+ for a robot maneuvering work or a product at a tool zone.

421 With means to interrelate movement of tool and of work:

This subclass is indented under subclass 420. Apparatus wherein the tool is moved during deformation, which apparatus is provided with means ensuring that tool movements and work movements are synchronized or interdependent.

- (1) Note. In the disclosures of this subclass, a work-moving mechanism is driven by that power source which drives the tool-moving mechanism.

SEE OR SEARCH CLASS:

- 100, Presses, subclass 353 for a press not provided for elsewhere having an interrelated

422 By gripper and/or endless chain:

This subclass is indented under subclass 419. Apparatus including either a work-gripping clamp or a band that moves in a closed loop about a plurality of separated noncoaxial pulleys or sprockets.

- (1) Note. The phrase "work-gripping clamp" is defined in the definition and notes of subclass 293.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 151 through 155 for similar means for handling the product of a cutting operation.
- 198, Conveyors: Power-Driven, subclasses 468.2+, 470.1+ 803.3+, and 803.8+ for a conveyor having load-gripping members, and appropriate subclasses for endless belt conveyors.
- 901, Robots, subcollection 31+ for a gripping device located on a robot.

423 With drum carrier for gripper:

This subclass is indented under subclass 422. Apparatus wherein the work-gripping clamp is mounted on a generally cylindrical rotating member.

424 With means to store workpieces (e.g., magazine):

This subclass is indented under subclass 419. Apparatus further provided with a receptacle that holds a supply of discrete articles of work to be deformed.

SEE OR SEARCH CLASS:

- 198, Conveyors: Power-Driven, subclass 311, 359+, and 523+ for a power-driven conveyor combined with a hopper or chute.

425 Including variable speed means:

This subclass is indented under subclass 419. Apparatus having means for changing the rate of movement of the work or the product.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 279, for disclosure of variable speed feed means and closed dies.

SEE OR SEARCH CLASS:

- 198, Conveyors: Power-Driven, subclass 577 for variable-speed conveyor drives.

426 Including product handling means:

This subclass is indented under subclass 419. Apparatus wherein the product* is moved or guided.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

134, 169 and 257, for disclosure of a deformer and a product-handler for that deformer.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 78+ for product-handling means in a cutting machine.

427 **Ejector:**

This subclass is indented under subclass 426. Apparatus comprising an element having a surface that is movable from a zone within the confines of a tool to a zone outside of the confines of said tool, whereby movement of the element positively displaces product from the tool.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 123+ for disclosure of an ejector within a cutting tool.

198, Conveyors: Power-Driven, subclasses 476.1+ and 574 for a conveyor having a load ejector.

428 **Including work guide:**

This subclass is indented under subclass 419. Apparatus wherein the handling is accomplished by passive means operating to define or limit the path of movement of moving work.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

230, for disclosure of a "loop-return" guide.

SEE OR SEARCH CLASS:

198, Conveyors: Power-Driven, subclass 599 and 633+ for passive means moving a load relative to a conveyor; and subclass 836.1 for a guide rail or other means retaining a load on an endless belt.

429 **WITH MEANS TO DRIVE TOOL:**

This subclass is indented under the class definition. Apparatus provided with means to move a movable tool toward work, or toward a cooperating tool, while deformation occurs as disclosed.

- (1) Note. For original placement of patents into this or indented subclasses, the following criteria should be applied: (a) "Drive" is tool movement toward the work for deformation of the work; (b) "Retraction" (i.e., tool movement away from the work) and other tool movements (e.g., to adjust the tool position relative to the work or another tool) are provided for only if tool drive is also claimed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

437+, and 445, for disclosure of particular tool-retracting means combined with tool-drive means.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 523+, for disclosure of means to drive a cutter, which means may be similar to means in this class (72) to drive a deformer.

430 **Including magnet, solenoid, or explosive:**

This subclass is indented under subclass 429. Apparatus wherein the tool moving means includes (a) a body capable of attracting ferrous material, or (b) a charge of chemically reactive material that rapidly expands upon actuation.

- (1) Note. This subclass is not the locus of patents disclosing an electric motor (i.e., a stationary part and a continuously rotating part, the rotation occurring as the result of passing a current of electricity through one or both of the parts), which motor is the drive means for the tool. This type of disclosure of a tool and an electric motor to drive the tool is located in other subclasses on the basis of the tool and its movement.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 575+ for disclosure of magnet or solenoid actuated cutting tool; and subclass 639.4 for explosive-actuated cutting tool.

431 Including yieldable connection in drive train to movable tool:

This subclass is indented under subclass 429. Apparatus wherein the tool moving means includes mechanism for transmitting motion from a driving member to the tool, and said mechanism permits motion of the driving member (in a direction tending to urge the tool toward the work) even though motion of the tool has stopped.

- (1) Note. Included in this and indented subclasses is disclosure of a shock-absorber within the motion-transmitting mechanism.

SEE OR SEARCH CLASS:

83, Cutting, subclass 543 for disclosure of yieldable connection to drive a cutting tool.

432 Including pneumatic or hydraulic connection:

This subclass is indented under subclass 431. Apparatus wherein the motion-transmitting mechanism includes a gaseous and/or fluid medium.

- (1) Note. A fluid medium, per se, is not necessarily yieldable or compressible. Therefore, a system comprising a generator of fluid pressure and a tool-moving motor using that pressure (the system having no pressure-relief device) is normally to be found in subclass 453.1.

SEE OR SEARCH THIS CLASS, SUBCLASS:

453.1, and see (1) Note above.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 639.1+ for disclosure of fluid-pressure-actuated cutting tool.

173, Tool Driving or Impacting, for disclosure of other hydraulic tool-drive means of general application.

433 Including metallic spring connection:

This subclass is indented under subclass 431. Apparatus wherein the motion-transmitting mechanism includes an elastic body made of metal*.

434 Coil spring:

This subclass is indented under subclass 433. Apparatus wherein the elastic body is in the form of a helical coil*.

435 Mechanical potential energy drive means only:

This subclass is indented under subclass 429. Apparatus wherein the tool-moving means includes mechanism for converting latent power into developed power to drive the tool.

- (1) Note. Potential-energy resulting from gravitational attraction is the usual source of energy, but a spring interconnecting a tool with a tool-housing is also a source of energy in some disclosures of this subclass.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 582+ for disclosure of constantly urged means for driving a cutting tool.

436 With means to check energy for subsequent release:

This subclass is indented under subclass 435. Apparatus provided with means for maintaining the power in a latent condition, which means may be made temporarily inoperative, thereby liberating the latent power.

- (1) Note. This subclass is the locus of patents disclosing a drop-hammer or trip-hammer wherein the drive means is held in a cocked position (i.e., energy is stored therein) until an operative triggers release of the energy.

437 Wherein energy is stored by retraction of tool:

This subclass is indented under subclass 435. Apparatus wherein latent power is generated by moving the tool away from the work or away from a cooperating tool.

438 With means to control force of blow:

This subclass is indented under subclass 437. Apparatus provided with means for regulating or adjusting the power (either latent or developed) available for deformation.

- (1) Note. Examples of disclosures include a spring-urged tool wherein the spring compression may be varied, a drop-hammer wherein the lift of the tool may be varied, and a lever-urged tool wherein the mechanical advantage of the lever may be varied.
- 439 Wherein tool is retracted by pinch rolls acting on rectilinearly moving tool support:**
This subclass is indented under subclass 437. Apparatus wherein the tool* retracting means includes an elongated member located between two counter-rotating rollers that engage the member.
- (1) Note. In use, the rollers are rotated so that their surface tangent to the member travel in a direction to retract the tool and pressure is exerted on the rollers tending to grip the member. The member, and the tool carried thereby, is lifted until the pressure is released, permitting the tool to drop.
- 440 Wherein tool is retracted by flexible strap:**
This subclass is indented under subclass 437. Apparatus wherein the tool retracting means is a pliant belt fastened at one end to the tool and at the other end to a device (e.g., crank, disk or the like) that moves cyclically.
- (1) Note. In use, as the device moves through part of its cyclic movement it lifts the tool and during the remainder of the movement of the device the tool is free to drop.
- 441 With means to selectably control movement of tool:**
This subclass is indented under subclass 429. Apparatus provided with means for regulating or adjusting the rate or length of travel of a tool, or for permitting a tool to move or be stationary, said means acting only at the option of an operative.
- (1) Note. Examples of disclosures included in this and indented subclasses are (a) means for starting a tool in its driving movement, (b) means for varying the speed or length of stroke of a tool, and (c) means for driving any of a plurality of tools by one or a plurality of drive means.
- 442 By drive means common to optionally selectable tools:**
This subclass is indented under subclass 441. Apparatus including a plurality of tools* and a single tool-moving means alternatively connected to one of said tools.
- SEE OR SEARCH CLASS:
83, Cutting, subclasses 549+ for disclosure of plural cutting tool selectably engageable with single drive; and subclasses 618+ for disclosure of plural cutting tools with same drive means.
- 443 To control speed of tool:**
This subclass is indented under subclass 441. Apparatus wherein the operative causes regulation of the rate of travel of the tool.
- 444 By means to connect and/or disconnect tool from its drive:**
This subclass is indented under subclass 441. Apparatus provided with a tool-moving means and a power source therefor, wherein the means can be joined to its power source or be separated therefrom while the tool is stationary, at the choice of the operative.
- SEE OR SEARCH CLASS:
83, Cutting, subclasses 571+ for disclosure of similar structure for driving a cutting tool.
- 445 With stored energy means to retract tool:**
This subclass is indented under subclass 429. Apparatus provided with means (additional to the tool-driver) for developing and accumulating latent power, which power moves the tool away from the work or away from a cooperating tool.
- (1) Note. In the disclosures of this subclass the energy is usually stored by or during movement of the tool toward the work, but the subclass is also intended as a locus of disclosures wherein energy is stored (e.g., a spring is cocked) by an operative or a motor.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

435, for disclosure of potential-energy means for driving a tool.

446 With means to permit tool positioning:

This subclass is indented under subclass 429. Apparatus provided with means for changing, or facilitating the changing of, the location of a tool relative to the work or a cooperating tool.

SEE OR SEARCH CLASS:

83, Cutting, subclasses 559+ and 561+ for disclosure of structure for positioning a cutting tool or tools.

483, Tool Changing, subclasses 28+ for a reciprocating tool machine tool combined with a tool transfer means.

447 To reposition line-of-action of tool:

This subclass is indented under subclass 446. Apparatus wherein the movable tool moves toward the work along a particular direction or course, of tool movement and wherein said means changes, or permits change in, the direction or course of tool movement.

(1) Note. Most patents in this subclass disclose tool repositioning at right angles to the direction of tool movement.

448 To position stationary tool of tool pair:

This subclass is indented under subclass 446. Apparatus wherein the movable tool cooperates with a second relatively immovable tool, and wherein said means changes the location of said second tool relative to the work or the movable tool.

449 Including gear-actuated tool support:

This subclass is indented under subclass 429. Apparatus wherein the tool is moved by a gear that is directly connected to the tool or to an element that carries the tool and partakes of all its movements.

(1) Note. The word “gear” is defined in the definition of Class 74, subclass 640 and is used herein to describe the same structure.

SEE OR SEARCH CLASS:

83, Cutting, subclass 603 and 629 for a disclosure of gear-actuated cutting tool.

450 Including link-actuated tool support:

This subclass is indented under subclass 429. Apparatus wherein the tool is moved by a pitman that is pivoted to a tool or to an element that carries the tool and partakes of all its movements.

451 Toggle links:

This subclass is indented under subclass 450. Apparatus wherein the pitman is part of toggle joint.

(1) Note. The phrase “toggle joint” is defined in the definition of subclass 300 of Class 81, and is used herein to describe the same structure.

SEE OR SEARCH CLASS:

83, Cutting, subclass 604 and 630 for disclosure of toggle-link-actuated cutting tool.

452.1 Including cam-actuated support:

This subclass is indented under subclass 429. Apparatus wherein the tool is moved by a cam engaging the tool or an element that carries the tool and partakes of all its movement.

(1) Note. The word “cam” is defined in the definition of Class 74, subclass 567 and is used herein to describe the same structure.

SEE OR SEARCH CLASS:

83, Cutting, subclass 602 and 628, for disclosure of cam-actuated cutting tool.

452.2 Pivotal cam:

This subclass is indented under subclass 452.1. Apparatus wherein the cam is journaled to move angularly about an axis of rotation.

452.3 Internal cam:

This subclass is indented under subclass 452.2. Apparatus wherein the cam includes radially inwardly facing camming surface.

452.4 Rotary cam:

This subclass is indented under subclass 452.2. Apparatus wherein the cam continuously rotates about the axis of rotation.

452.5 Eccentric circle (e.g., crank):

This subclass is indented under subclass 452.4. Apparatus wherein the camming surface is spaced equidistant from the cam's central axis and the axis of rotation is offset from the cam's central axis.

452.6 Radial cam face:

This subclass is indented under subclass 452.4. Apparatus wherein the camming surface is oriented perpendicular to the axis of rotation.

452.7 Axial cam face:

This subclass is indented under subclass 452.4. Apparatus wherein the camming surface is oriented parallel to the axis of rotation.

452.8 Linear cam:

This subclass is indented under subclass 452.1. Apparatus wherein the cam moves along a straight path.

452.9 Inclined cam (e.g., inclined plane):

This subclass is indented under subclass 452.8. Apparatus wherein the camming surface oriented at a constant angle to the line or plane of the actuating movement.

453.01 Including pneumatic- or fluid-actuated tool support:

This subclass is indented under subclass 429. Apparatus including means to force the tool (or an element that carries the tool and partakes of all its movement) to move toward the work and perform a desired deforming operation by use of a fluent of liquid medium under pressure.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 54+, for a pressurized-fluid means engaging and deforming work.
- 432, for fluid means in a yieldable connection.
- 481.2, for a pneumatic- or fluid- actuated means to reposition or retain a tool face with respect to the tool support or holder.

- 481.3, for a threaded means to move or hold a tool face with respect to its support or holder.

SEE OR SEARCH CLASS:

- 83, Cutting, subclasses 639.1+, for a fluid pressure-actuated driver for a cutting tool.
- 100, Presses, subclasses 269.01+ for a fluid pressure actuated reciprocating press construction

453.02 Multiple or staged drive means:

This subclass is indented under subclass 453.01. Apparatus including an additional means to force the tool to move toward the work and perform the desired deforming operation.

- (1) Note. Means acting to move the tool in the direction away from the work, e.g., a biasing return spring, is not considered to be a tool drive means.
- (2) Note. Means serving to yieldably connect or cushion a tool relative to a tool drive means is not considered to be a tool drive means.

453.03 With mechanical drive means:

This subclass is indented under subclass 453.02. Apparatus wherein the additional means forcing the tool toward the work includes a mechanical structure, e.g., a screw, cam, lever, or hammer.

453.04 Fluid high pressure/mechanical low pressure:

This subclass is indented under subclass 453.03. Apparatus wherein the first means, the fluid means, forcing the tool toward the work serves to urge the tool with relatively high force and wherein the second means, the mechanical means, serves to urge the tool with relatively low force.

453.05 Displacement additive:

This subclass is indented under subclass 453.02. Apparatus wherein one of the means forcing the tool toward the work transmits movement to the other forcing means so that the amount of tool movement is dependent on the total movement of the two means.

453.06 Pressure additive:

This subclass is indented under subclass 453.02. Apparatus wherein one of the means forcing the tool toward the work transmits force to the tool and wherein the other means forcing the tool toward the work transmits force to the tool so that the total force acting on the tool represents the sum of the forces of the two forcing means.

453.07 Axially aligned pistons:

This subclass is indented under subclass 453.06. Apparatus wherein the first means and the second means forcing the tool toward the work are pneumatic or fluid actuated and wherein each includes piston means, the first and second piston means being connected together in alignment along the direction of movement of the tool.

453.08 Independently actuated means:

This subclass is indented under subclass 453.06. Apparatus including means to supply liquid medium under pressure to one of the tool forcing means and means to supply liquid medium under pressure to the other of the tool forcing means wherein the first supply and the second supply are not entirely dependent one on the other.

453.09 Pull-down press:

This subclass is indented under subclass 453.06. Apparatus including a tool supporting structure such that the tool is positioned above the floor that would be the general support means for the apparatus and wherein the tool-forcing means are positioned below the floor and act through connecting tie members to force the tool down toward the work and the floor in a deforming stroke.

453.1 Utilizing stored energy:

This subclass is indented under subclass 453.01. Apparatus including provision to accumulate a tool moving force for subsequent release.

453.11 Stored kinetic energy:

This subclass is indented under subclass 453.1. Apparatus wherein the force accumulation provision includes a member adapted to be put in motion so that the energy of motion of that

member can be subsequently utilized to perform a deforming operation.

- (1) Note. The member in motion is other than parts normally in motion during approach of the tool toward the work; i.e., stored energy is intended to be subsequently utilized.

453.12 Pull-down press:

This subclass is indented under subclass 453.01. Apparatus including a tool supporting structure such that would be the general support structure of the apparatus and wherein the tool forcing means is positioned below the floor and acts through connecting tie members to force the tool down toward the work and the floor in a deforming stroke.

453.13 Including fluid cushion for die opposite to ram:

This subclass is indented under subclass 453.01. Apparatus including a tool couple wherein one tool includes a pneumatic- or fluid-actuated tool support and wherein the other tool is supported on a compressible fluid medium such that the other tool will move away from the driven tool under extreme pressure.

453.14 With ram or tool support aligning means:

This subclass is indented under subclass 453.01. Apparatus including a tool couple and including means to adjust the support of one tool of the couple or means to adjust the guiding means of the driven tool of the couple to change the abutting relationship of the two tools.

453.15 Randomly manipulated or work-supported tool:

This subclass is indented under subclass 453.01. Apparatus including provision to allow the apparatus to be moved at will relatively to the deforming station, (i.e., the apparatus is adapted to be brought to the work rather than have the work brought to the apparatus) or including provision to attach the apparatus to the work to be supported thereby during deformation of the work.

453.16 With handle for manual manipulation:

This subclass is indented under subclass 453.15. Apparatus including a structure particularly adapted to be grasped by an operative to assist in moving the apparatus to the deforming station.

453.17 Riveting tool:

This subclass is indented under subclass 453.16. Apparatus particularly adapted to deform a rodlike fastener to cause that fastener to be confined to not move through an aperture in another member.

- (1) Note. A “pop rivet” consisting of a tube and encased rod is considered to be a single work part; accordingly, a device for causing such a rivet to engage the walls of an opening in another member is proper for this subclass, provided that the device engages only parts of the rivet.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 700+ for means to assemble a first work part which is tubular and a second work part which is rodlike.

453.18 Having hydraulic or pneumatic return:

This subclass is indented under subclass 453.01. Apparatus wherein the tool is moved by a fluent or liquid medium toward the work and is also moved away from the work by a fluent or liquid medium.

453.19 Riveting tool:

This subclass is indented under subclass 453.18. Apparatus particularly adapted to deform a rodlike fastener to cause that fastener to be confined to not move through an aperture in another member.

- (1) Note. A blind rivet consisting of a tube and an encased rod is considered to be a single work part; accordingly, a device for causing such a rivet to engage the walls of an opening in another member is proper for this subclass, provided that the device engages only parts of the rivet.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclasses 700+ for means to assemble a first work part which is tubular and a second work part which is rodlike.

454 Including screw-actuated tool support:

This subclass is indented under subclass 429. Apparatus wherein the tool is directly moved by a helically threaded member threadedly connected to the tool or to an element that carries the tool and partakes of all its movements.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 248, for disclosure of “screw-down” mechanism in a roller-couple.
481.3+, for a threaded means to position or retain a tool face to a support or holder therefor.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 631, for disclosure of screw-actuated cutting tool.

455 WITH TOOL CARRIER (E.G., PRESS FRAME):

This subclass is indented under the class definition. Apparatus provided with means for constraining the movement of a tool to a predetermined direction or course of movement.

- (1) Note. In a typical patent of this subclass the disclosure is clear as to metal deformation. However, the claimed subject matter recites merely the environment of the tool or its support. For example, a patent herein may claim the housing wherein the tool is located for movement, or guide wherein the tool support slides.

SEE OR SEARCH CLASS:

- 83, Cutting, subclass 701 for disclosure of a frame or housing for a cutting device.

456 With guide for rectilinearly moving tool:

This subclass is indented under subclass 455. Apparatus provided with passive means limiting the path or movement of the tool to a straight line.

SEE OR SEARCH CLASS:

83, Cutting, subclass 523 for disclosure of a guide for a movable cutter.

457 BY OR WITH WORK CONSTRAINER AND/OR MANIPULATED WORK FORCER:

This subclass is indented under the class definition. Subject matter comprising means for (a) holding a work-portion against movement, or (b) causing movement of a work portion, or both (a) and (b) which means, as disclosed, facilitates or causes deformation by or during movement of one portion of a workpiece relative to another portion of said workpiece.

- (1) Note. The term “by or with”, in the title, is intended to include structure wherein the deformation occurs as a result of the intended use of a claimed work-holder or work-forcer; or structure wherein deformation is caused by a disclosed (but not claimed) apparatus, which latter structure includes a claimed work-holder or work-forcer in addition to said apparatus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

211, for disclosure of a carrier for a manipulated or maneuverable-roller couple.

458 Comprising lever manipulated to force work:

This subclass is indented under subclass 457. Implement wherein movement of one work portion (relative to another) is caused by a device having means for holding the work portion fixedly thereto and an elongated extension, which device is disclosed as moved by an operative grasping the extension.

- (1) Note. It is not necessary for a work-holder to grip the work tightly. An element in frictional engagement with the work, whereby relative movement therebetween is restrained will fit the concept of this subclass.

459 With work-complementing tool face adjacent to work-gripping clamp:

This subclass is indented under subclass 458. Implement provided with a work-engaging deforming surface closely proximate the work-holding means, which surface, as disclosed, conforms to at least a part of the work.

- (1) Note. The device disclosed in this and the preceding subclass is sometimes known in the plumbing trade as a “pipe hickey”. In use, a hook on the device is applied to the work and force is applied to the lever in a direction tending to partially wrap the work around the tool-face defined, which tool face then mates with the inner curve of the work deformed thereby.

460 Comprising nondeforming work-gripping clamp having adjacent tool face:

This subclass is indented under subclass 457. Device having a work-gripping clamp for holding a work portion, and provided with a work-engaging deforming surface closely proximate said clamp.

- (1) Note. The term “work-gripping clamp” has been defined in the definition of subclass 293 and is used herein to describe the same structure.

461 Comprising work-stopping abutment:

This subclass is indented under subclass 457. Device having means which provides an obstacle to movement of a workpiece during deformation thereof.

- (1) Note. Included in this subclass is disclosure of a work-gage or back stop, provided that the line-of-reaction of such device is along or parallel to the path of movement of the workpiece.

462 TOOL AND/OR TOOL HOLDER:

This subclass is indented under the class definition. Apparatus comprising a tool*; or comprising a device connected to a tool* for mounting or supporting the tool against gravity, which device partakes of all the motion of the tool during deformation.

- (1) Note. With respect to the definition of tool-holder (i.e., the supporting device) an original patent claiming relative movement of a tool and its tool-holder for purposes of adjustment of one relative to the other may be placed in this or an indented subclass.
- (2) Note. This and indented subclasses are the residual loci of patents disclosing metal-deforming tools of general or unspecified use. Patents disclosing a specific tool, (e.g., fluent tool, roller-couple, closed-die) will be found in corresponding subclasses higher in the schedule than this one. Those patents claiming a tool particularly identified by disclosure as usable in a specific environment have been cross-referenced into the subclass pertaining to that environment.
- (3) Note. During the analysis of patents to be placed in this and indented subclasses, the names applied to tools, (e.g., “anvil”, “die”, “mandrel”, etc.) and the functions attributed to such tools, (e.g., “threading-die”, “wedging block”, etc.) were found to be arbitrary or not pertinent. Art terminology was found to refer to essentially similar structures by different names or functions, or to apply the same names or functions to widely divergent structures. For these reasons, the traditional names for the tools placed herein have been disregarded, and classification thereof has been based on structure without regard to function.
- 463 With nondeforming passageway:**
This subclass is indented under subclass 462. Apparatus having an orifice therein, which orifice facilitates the movement of material there-through but does not deform work.
- (1) Note. The orifice permits the passage of such exemplary materials as lubricating oil, air, coolant, work or product, but the orifice itself has no deforming function on work or product pieces.
- 464 Including deforming tool and cutting tool:**
This subclass is indented under subclass 462. Apparatus having at least two members or portions of a member, wherein one of said members or portions is disclosed as a cutter and another of said members or portions is disclosed as a deforming tool*.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
71, 186, 204, and 325+, for disclosure of a composite cutting, deforming tool.
- 465.1 Including flexible or yieldable tool or support:**
This subclass is indented under subclass 462. Apparatus wherein the tool is pliant or resilient, or wherein the tool or its tool-holder is mounted on a pliant or resilient means.
- (1) Note. This subclass provides the locus for patents disclosing a pressure resistant tool capable of moving to absorb part of the pressure required for deformation and of returning to its original position.
- 466 Flexible or articulated backup:**
This subclass is indented under subclass 465.1. Apparatus wherein the tool operates as a passive reaction member, and wherein the tool or its tool-holder comprises a pliant member or a plurality of elements jointly linked together to permit the elements to move relatively to each other.
- 466.2 Bending mandrel:**
This subclass is indented under subclass 465.1. Apparatus wherein a passive implement is received within a passage in the work* for the purpose of supporting the passage during a bending process.
- 466.3 Overload release:**
This subclass is indented under subclass 465.1. Apparatus adapted to breakaway upon occurrence of excessive force.
- 466.4 Riveting tool:**
This subclass is indented under subclass 465.1. Apparatus particularly adapted to deform a rodlike fastener to cause that fastener to be confined to not move through an aperture in another member.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
453.17, 453.19, for a riveting tool which includes a pneumatic- or fluid-actuated tool support.
- SEE OR SEARCH CLASS:
29, Metal Working, subclass 243.521 and 243.53+ for a riveting tool that recognizes the presence of a first and second work piece.
- 466.5 Rivet buckler or dolly:**
This subclass is indented under subclass 466.4. Apparatus wherein an implement passively engages the rodlike fastener during deformation.
- 466.6 Handtool (e.g., hammer or dolly):**
This subclass is indented under subclass 465.1. Apparatus wherein an implement is adapted to be manually driven or manipulated during use.
- 466.7 Fluid pressure supported:**
This subclass is indented under subclass 465.1. Apparatus wherein a gas or a liquid is confined in an enclosure which functions as an elastic member.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
453.13, for a press using a fluid pressure support.
- 466.8 Resilient material:**
This subclass is indented under subclass 465.1. Apparatus wherein a tool* or tool holder* consists in part or whole of a substance which yields under pressure and elastically rebounds upon relieving the pressure.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
54+, for application of a fluent medium (e.g., an elastomeric tool face).
350+, for blank holders.
- 466.9 Metal spring (e.g., coil or leaf):**
This subclass is indented under subclass 466.8. Apparatus wherein the resilient material is a mechanically configured metal member which operates within the elastic limits of that metal.
- (1) Note. A metal member experiencing permanent deformation is excluded from this subclass.
- 467 Tool comprising closed periphery deforming passageway:**
This subclass is indented under subclass 462. Apparatus wherein the tool defines an orifice having an uninterrupted circumference, and the work-engaging boundary surface of the orifice is disclosed as deforming work that moves bodily therethrough.
- SEE OR SEARCH CLASS:
425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 461+ for a means providing a shaping orifice for extrusion apparatus for nonmetals.
- 468 Including adjustable size or multiple passageway:**
This subclass is indented under subclass 467. Apparatus wherein the dimensions of the orifice may be altered or wherein a plurality of orifices is provided.
- 469 Tool-comprising die plate having ribs and/or grooves:**
This subclass is indented under subclass 462. Apparatus including a work-deforming surface having a plurality of extended, alternating hills and valleys bounded generally by two substantially parallel planes.
- (1) Note. The tool defined above is used in the disclosures placed in subclasses 88+. For further description of such a tool and its action on the work especially when two such tools cooperate with each other, see the definitions and notes of subclasses 88+.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
88+, 180, 188, and 221+, for disclosures of a tool having ribs and/or grooves.

470 Including tool couple or die couple (e.g., opposed die faces):

This subclass is indented under subclass 462. Apparatus comprising two tools disposed opposite one another such that work may be located therebetween.

- (1) Note. Patents placed in this and indented subclasses disclose a tool-couple wherein the tools may be fixed or movable relative to each other during use, but in either case it is clear from the disclosure that the tools cooperate with each other to form a tool-couple.

471 With intermediate tool:

This subclass is indented under subclass 470. Apparatus provided with at least a third tool, which the third tool is located in the space between the work-engaging faces of the two tools.

- (1) Note. Exemplary patents in this subclass disclose a core supporting the interior of hollow-work* while two tools deform the exterior of the work into the shape of the core.

472 Including plural tool couples:

This subclass is indented under subclass 470. Apparatus comprising at least two separate tool couples.

- (1) Note. For placement in this subclass, a patent should claim two (or more) tool-couples, each of the two having the limitations stated in the definition of subclass 470. Exemplary patents herein disclose the tool couples operating sequentially or simultaneously.

473 Having adjustable face:

This subclass is indented under subclass 470. Apparatus wherein at least one of the tools engages work with a surface having a shape or configuration that can be changed.

474 Having nonsymmetrical face:

This subclass is indented under subclass 470. Apparatus wherein the work-engaging surface of one tool of a tool-couple has a nonplanar shape of configuration different from the work-

engaging surface of the other tool of said tool-couple.

- (1) Note. For the purpose of this definition a tool-couple having mirror-image faces is considered to be symmetrical and a patent disclosing such tool faces will not be placed in this or indented subclasses, but will be found in subclass 470, or an appropriate subclass indented thereunder.

475 Complementary faces:

This subclass is indented under subclass 474. Apparatus wherein the work-engaging surfaces of the tools conform to each other (with allowance for the presence of uniform-thickness work there-between).

SEE OR SEARCH THIS CLASS, SUBCLASS:

88, 105, 179, 196, 375, 385, 414, and 469, for additional disclosure of tool-couple having complementary tool-faces.

476 Having unitary tool face:

This subclass is indented under subclass 462. Apparatus comprising one tool having at least one work-engaging surface that acts (or reacts) as a single device during deformation.

- (1) Note. This and indented subclasses do not bar therefrom a disclosure of a tool having a surface with a plurality of work deforming faces, provided that only one face of such tool is used (at any one period of time) during one deformation, and another face is used during another deformation. See the definitions and notes for subclasses 477 and 478 for such usages.

477 Including optionally selectable faces:

This subclass is indented under subclass 476. Apparatus wherein the tool has at least two work-engaging surfaces, of which surfaces one or another is used, at the choice of the operative, during deformation.

- (1) Note. The disclosures of this subclass should not be confused with those of subclasses having the phrase "plural faces" (or equivalent expression) in their titles. In this subclass (477) one face of a

tool or another face (or another portion of the first-mentioned face) is used at the option of the operative, and this choice is clear from the claimed disclosure. In the other (i.e., “plural faces”) subclasses, the use of plural faces in succession or alternation (as well as simultaneously) is clear, or the specification falls short of clearly disclosing a choice of faces.

478 Comprising plural sections fixed together in use (e.g., adjustable or collapsible):

This subclass is indented under subclass 476. Apparatus wherein the work-engaging surface is constructed from the surfaces of a plurality of elements, which elements are held rigidly with respect to each other during a deforming operation.

- (1) Note. This subclass is a locus of patents disclosing a tool that can be collapsed for insertion into, or removal from, a workpiece.

479 With elongated extension fixed to tool face in use (e.g., handle or shank):

This subclass is indented under subclass 476. Apparatus having a prolongation that performs a function other than deformation.

- (1) Note. The function stated is usually to facilitate the grasping of the tool by the hand of the operative, but the function may also be to serve as a means to connect the tool to a tool-driver.

480 Adjustable relative to tool face before use:

This subclass is indented under subclass 479. Apparatus wherein the position of the prolongation with respect to the tool-face* may be changed prior to a deforming operation.

481.1 With support or holder for adjustable or removable tool face:

This subclass is indented under subclass 476. Apparatus provided with a carrying member in which the tool is so mounted that it, or a portion of it, may be changed or positioned or extracted relative to the member.

481.2 Pneumatic- or fluid-actuated means to move or hold tool face:

This subclass is indented under subclass 481.1. Apparatus including means utilizing a fluent or liquid medium under pressure to reposition or retain the tool face with respect to the support or holder.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 54+, for direct application of a fluent medium to engage and deform metal.
453.01+, for a pneumatic- or fluid-actuated tool metal deforming tool.

481.3 Threaded means to move or hold tool face:

This subclass is indented under subclass 481.1. Apparatus which a helically ridged surface interfittingly engages another member to reposition or retain the tool face with respect to the support or holder.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 454, for a screw actuated tool support for metal deforming.

481.4 To move by threaded member that travels along tool face:

This subclass is indented under subclass 481.3. Apparatus wherein the helically ridged member turns about an axis that is parallel to the plane of the tool face, so that it serves to reposition the tool parallel to that plane.

481.5 Threaded means “telescopically” interfits with tool face:

This subclass is indented under subclass 481.4. Apparatus wherein the tool face includes a generally cylindrical opening for receiving and interfitting with the helical ridges of the helically ridged member.

481.6 To hold by actuating a clamping mechanism:

This subclass is indented under subclass 481.3. Apparatus wherein the helically ridged member engages another member to cause that member to retainingly grasp the tool face with respect to the tool support or holder.

481.7 Threaded means comprising “fastener”:

This subclass is indented under subclass 481.6. Apparatus wherein the threaded means comprises a conventional, hardware store item; e.g., a screw or bolt.

481.8 To hold by threaded means comprising “fastener”:

This subclass is indented under subclass 481.3. Apparatus wherein the threaded means comprises a conventional, hardware store item; e.g., a screw or bolt, and serves to retain the tool face in position on the support or holder.

481.9 To hold by binding tool face:

This subclass is indented under subclass 481.3. Apparatus wherein the end of the helically ridged member directly engages tool face to urge the tool face to forcibly interfit with the support or holder, thereby to retain the tool face in position with respect thereto.

482.1 Cam to move or hold tool face:

This subclass is indented under subclass 481.1. Apparatus including a rotary member or a rectilinearly moving member having a contoured surface utilized to reposition or retain the tool face with respect to the support or holder.

SEE OR SEARCH THIS CLASS, SUBCLASS:

452, for a cam-actuated metal deforming tool support.

482.2 To hold by actuating a clamping mechanism:

This subclass is indented under subclass 482.1. Apparatus wherein the member having a contoured surface engages another member to cause that member to retainingly grasp the tool face with respect to the tool support or holder.

482.3 Wedge shaped cam:

This subclass is indented under subclass 482.1. Apparatus including a rectilinearly moving member having a contoured surface utilized to reposition or retain the tool face with respect to the support or holder.

482.4 To move tool face:

This subclass is indented under subclass 482.3. Apparatus adapted to reposition the tool face with respect to the support or holder.

482.5 Engaging dovetail on tool face:

This subclass is indented under subclass 482.3. Apparatus cam is used between an inwardly tapered tenon on the tool face and a correspondingly shaped recess in the tool support or holder to retain the tool face in position on support or holder.

482.6 Lever to move tool face:

This subclass is indented under subclass 481.1. Apparatus including a torque arm pivoted about a fulcrum to reposition the tool face with respect to the support or holder.

482.7 Ratchet to move tool face:

This subclass is indented under subclass 481.1. Apparatus including a linearly movable rod engaged by a one way locking mechanism and a mechanism which indexably engages the rod to incrementally move the tool face with respect to the support or holder.

482.8 Gear to move tool face:

This subclass is indented under subclass 481.1. Apparatus including a rotary toothed wheel adapted to interfit with cooperating surfaces of another rotary toothed wheel or a toothed bar to reposition the tool face with respect to the support or holder.

482.9 Magnetic means to hold tool face:

This subclass is indented under subclass 481.1. Apparatus including a member which utilizes an electromagnetic field to retain the tool face with respect to the support or holder.

482.91 Spring to hold tool face:

This subclass is indented under subclass 481.1. Apparatus including an elastic member to retain the tool face with respect to the support or holder.

482.92 Pin to hold tool face:

This subclass is indented under subclass 481.1. Apparatus including a rod and a mating slot to retain the tool face with respect to the support or holder.

482.93 Tool face held by friction fit to support:

This subclass is indented under subclass 481.1. Apparatus which utilizes an interference engagement between the tool face holder and

the tool face to retain the tool face with respect to the support or holder.

482.94 Tool face threaded directly to support:

This subclass is indented under subclass 482.93. Apparatus wherein the helically ridged surface is directly on or in tool face and is intended to interfit with a cooperating surface of the support or holder.

483 MISCELLANEOUS:

This subclass is indented under the class definition. Apparatus that is not in conformance with the definition of any prior class in this schedule.

CROSS-REFERENCE ART COLLECTIONS

The following subclasses are collections of published disclosures pertaining to various specified aspects of the metal-deforming art which aspects do not form appropriate bases for subclasses in the foregoing classification (i.e., subclasses superior hereto in the schedule), wherein original copies of patents are placed on the basis of proximate function of the apparatus.

These subclasses assist a search based on remote function of the apparatus and may be of further assistance to the searcher, either as a starting point in searching this class or as an indication of further related fields of search inside or outside the class. Thus, there is here provided a second access for retrieval of a limited number of types of disclosures. Disclosures are placed in these subclasses for their value as references and as leads to appropriate main or secondary fields of search, without regard to their original classification or their claimed subject matter. The disclosures found in the following subclasses are examples, only, of the indicated subject matter, and in no instance do they represent the entire extent of the prior art.

700 DEFORMING SPECIFIED ALLOYS OR UNCOMMON METAL OR BIMETALLIC WORK:

Disclosure of metal deformation, particularly emphasizing the composition of the metal, or specifying a rare metal as undergoing deformation (e.g., tantalum, beryllium or other such metal not usually thought of in connection with deformation), or reciting two or more metals in laminar form.

701 PREVENTING DISTORTION:

Disclosure of metal deformation wherein unwanted deformation is precluded.

- (1) Note. The term “unwanted deformation” is meaningful only in accordance with the intent of applicant, patentee or author as expressed in the disclosure. To be placed herein a disclosure should clearly indicate a deliberate attempt to prevent a deformation clearly stated to be undesired. Examples of terms used to express undesired distortion include: “distortion”, “lateral deflection”, “buckling”, “warping”, “wind”, “twisting”, “masking”, “collapsing”, “crushing”, “flattening”, “crowding”, “wrinkling” and “cobbling”. It is obvious that some of the terms are also used to describe desired deformation, therefore some care should be taken to properly assess the disclosed intent.

702 OVERBENDING TO COMPENSATE FOR SPRINGBACK:

Disclosure of metal deformation wherein the metal is stressed to a position beyond that which is desired, in the expectation that when the stress is released, the resilience of the metal will restore it to the position desired.

703 KNURLING:

Disclosure of metal deformation that functions to produce a series of small ridges, usually parallel to each other, and also usually associated with a second such series angularly related to the first series.

704 CHAMBER-ADJUSTING TOOL:

Disclosure of metal deformation by a device particularly arranged and intended to change the relationship between the parts of a front-end or steering-linkage suspension on an automobile.

705 VEHICLE BODY OR FRAME STRAIGHTENER:

Disclosure of metal deformation by an apparatus or structure particularly adapted and intended to restore an automobile, railway car, or other transport carriage or its original shape.

- 706 EXPLOSIVE:**
Disclosure of metal deformation produced by explosive forces.
- 707 MAGNETISM:**
Disclosure of metal deformation produced by magnetic forces.
- 708 REVERSE DRAWING:**
Disclosure of metal deformation using a reverse drawing step or apparatus.
- 709 SUPERPLASTIC MATERIAL:**
Disclosure of metal deformation of materials which have superplastic properties, i.e., those that can exceed their normal elastic limit when subjected to certain conditions such as elevated temperatures.
- 710 VIBRATING:**
Disclosure of metal deformation including a vibration step or apparatus.
- 711 HYDROSTATIC EXTRUSION:**
Disclosure of metal deformation produced by the extrusion of metal using hydrostatic forces.
- 712 ELECTRICAL TERMINAL CRIMPER:**
A cross reference art collection of apparatus for attaching an electrical connector to an end of a wire intended to conduct electricity there-through.
- 713 METHOD OF MAKING VEHICLE POWER TRANSMITTING SHAFT:**
Disclosure of a process of metal deformation producing a member which passes on motion and torque for use on a transport carriage.
- 714 METHOD OF MAKING UNIVERSAL JOINT SHELL:**
Disclosure of a process of metal deformation producing a particular coupling between two rotating shafts, specifically directed to the socket on the end of one shaft for receiving the end of the other shaft.
- 715 METHOD OF MAKING CAN BODIES:**
Disclosure of a process of metal deformation producing a fluid holding vessel.
- The definitions for FOR 100 through FOR 102 below correspond to the definitions of the abolished subclasses under Class 72 from which these collections were formed. See the Foreign Art Collections in the Class 72 schedule for specific correspondences. [Note: The titles and definitions for *indented* art collections include all the details of the one(s) that are hierarchically superior.]
- FOR 100 Tube making and/or reshaping:**
Foreign art collection relating to the manufacture and/or deformation of a tube*.
- FOR 101 Comprising use of internal tool:**
Foreign art collection including the use of an active or passive tool located within the interior of the work during the reshaping operation.
- FOR 102 Including flexible or yieldable tool or support:**
Foreign art collection wherein the tool is pliant or resilient, or wherein the tool or its tool-holder is mounted on a pliant or resilient means.
- END

FOREIGN ART COLLECTIONS